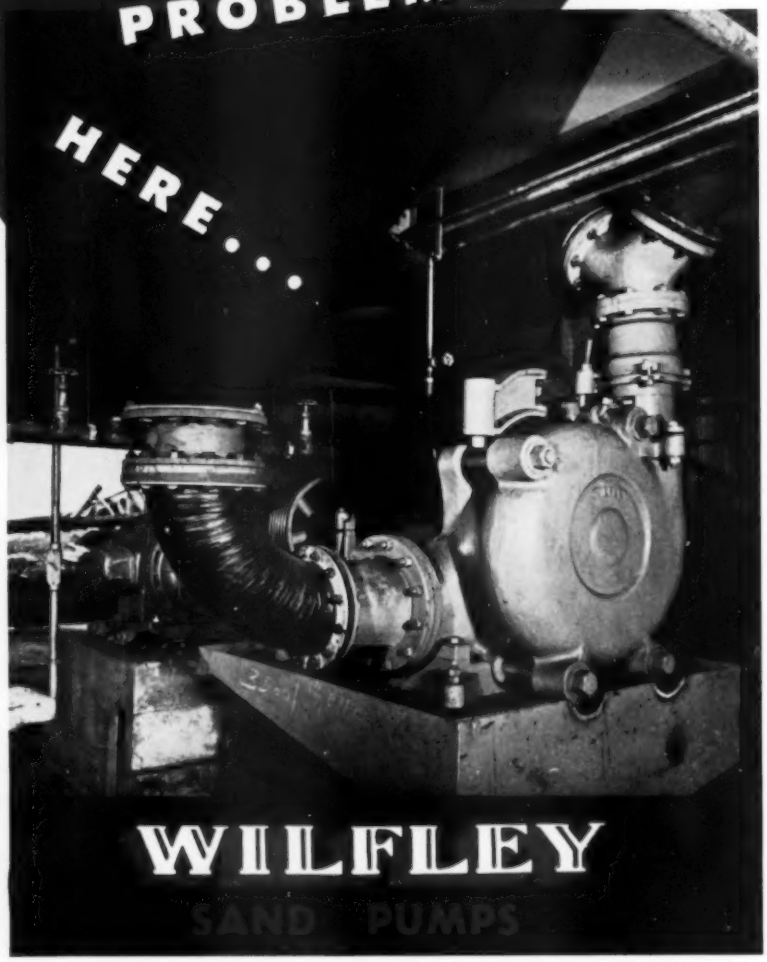
MINING engineering

OCTOBER 1961

NO MAINTENANCE PROBLEMS HERE...



Pump shutdown can bring your entire production line to a standstill. Costly downtime for repairs is eliminated when you install Wilfley Sand Pumps. With Wilfley's exclusive "quick-change" features parts are replaced in a matter of minutes. Simplified, packingless design and rugged construction guarantee low cost, trouble-free pumping and long pump life.

Wilfley Sand Pumps may be fitted with interchangeable electric furnace alloy irons, rubber covered wear parts, special application alloys and synthetic elastomers to best meet the needs of your pumping installation.

Write, wire or phone for complete details.

Wilfley Sand Pumps
"Companions in Economical Operation"
Wilfley Acid Pumps

FOR MAXIMUM PUMPING ECONOMY EVERY INSTALLATION IS JOB ENGINEERED.

A. R. WILFLEY and SONS, INC.

DENVER, COLORADO, U.S.A.—P. O. BOX 2330
NEW YORK OFFICE: 122 EAST 42ND ST., NEW YORK CITY 17, N.Y.

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COMING EVENTS

Oct. 15-18, International Mining Days sponsored by the New Mexico Mining Assn. and the El Paso Chamber of Commerce, Hilton Hotel, El Paso, Texas.

Oct. 18-21, AAPG Mid-Continent Regional Meeting, Amarillo, Texas.

Oct. 25-27, 11th Annual Meeting Gulf Coast Assn. of Geological Societies, Granada Hotel, San Antonio, Texas.

Oct. 25-28, 14th Pacific Coast Regional American Ceramic Society Convention, Jack Tar Hotel, San Francisco.

Nov. 1-3, Southwestern Federation of Geological Societies Fourth Annual Meeting, El Paso, Texas.

Nov. 3, Pittsburgh Sections of AIME and NOHC Off-the-Record Meeting, Penn-Sheraton Hotel, Pittsburgh.

Nov. 3-4, Joint Meeting Central Appalachian Section, AIME and the West Virginia Coal Mining Institute, The Greenbrier, White Sulpher Springs, W. Va.

Nov. 4, Carolinas Section, AIME, annual meeting, Barringer Hotel, Charlotte, N. C. For information write Neil O. Johnson, Foote Mineral Co., Kings Mountain, N. C.

Nov. 5-9, 31st Annual International Meeting of the Society of Exploration Geophysicists, Denver.

Nov. 13-15. Steel Founders' Society of America Technical and Operating Conference, Hotel Carter, Cleveland.

Nov. 29-30, University of Michigan College of Engineering, Effective Utilization of Engineering Personnel, Kellogg Center, East Lansing, Mich.

Dec. 4, Annual Meeting Arizona Section of AIME, Pioneer Hotel, Tucson, Ariz.

Dec. 4-5, New York University, Beryllium Conference, New York City.

Dec. 6-8, Nineteenth Electric Furnace Conference, sponsored by The Metallurgical Society of AIME. Penn-Sheraton Hotel, Pittsburgh.

Jan. 15-17, 1962, AIME Minnesota Section Annual Meeting-University of Minnesota 23rd Annual Mining Symposium, Hotel Duluth, Duluth.

Feb. 18-22, AIME Annual Meeting, Statler-Hilton & Astor Hotels, New York City.

Mar. 12-13, Steel Founders' Society of America Annual Meeting, Drake Hotel, Chicago.

Mar. 26-29, AAPG-SEPM Annual Meeting, jointly with AAPG-SEPM-SEG Pacific Sections, Civic Auditorium, San Francisco. Fairmont Hotel to be hotel headquarters.

Apr. 5-6, ASME-SAM Management Engineering Conference, Statler-Hilton Hotel, New York City.

Apr. 9-11, 45th National Open Hearth and Blast Furnace, Coke Oven and Raw Materials Conference, sponsored by The Metallurgical Society of AIME. Sheraton-Cadillac Hotel, Detroit.

Apr. 9-13, ASME Metals Engineering Conference, Sheraton Cleveland Hotel, Cleveland.

Apr. 12-14, AIME Pacific Southwest Mineral Industry Conference, Palace Hotel, San Francisco.

Apr. 23-25, 12th Annual Meeting, Rocky Mt. Section, AAPG, Salt Lake City.

Apr. 26-28, AIME Pacific Northwest Metals and Minerals Conference, Ben Franklin Hotel, Seattle, Wash.

May 3-5, 5th Rock Mechanics Symposium, University of Minnesota, Minneapolis.

May 7-9, American Mining Congress Coal Convention, Pittsburgh.

May 7-11, American Foundrymen's Society 66th Annual Castings Congress & Exposition to be held in conjunction with the 29th International Foundry Congress, Cobo Hall, Detroit.

May 28-June 1, 4th International Coal Preparation Congress, Harrogate, England.

June 4-6, 1962, Nuclear Congress and Atomic Exposition, New York Coliseum, New York City.

June 7-8, AIME Coal Division Field Meeting, Price, Utah.

MINING engineering

VOL. 13 NO. 10 OCTOBER 1961

COVER *Whether prospectors or geologists, such men will be playing an increasingly important role in the mineral industry. Symbolic of modern prospecting, artist Herb McClure has depicted two men in a key phase of prospecting—mapping. In the Lake Superior region, mapping may become easier as shown by the article starting on page 1156.*

ARTICLES

DEPARTMENTS

PLUS

MINING ENGINEERING staff, Society of Mining Engineers, and AIME Officers are listed with "The Drift Of Things". Number of copies printed of this issue: 15,500.

Address insertion orders and copy to MINING ENGINEERING, 345 E. 47th St., New York 17, N. Y. Send plates to: MINING ENGINEERING, c/o Lew A. Cummings Co. Inc., 215 Canal St., Manchester, N. H. Published monthly by the American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., 345 E. 47th St., New York 17, N. Y. Telephone: PLaza 2-6800; TWX NY 1-1304. Subscription $8 per year for non-AIME members in the U. S., & North, South, & Central America; $10 all other countries; $6 for AIME members, or $4 additional for members only in combination with a subscription to "Journal of Metals" or "Journal of Petroleum Technology". Single copies, $.75; single copies foreign, $1.00; special issues, $1.50. AIME is not responsible for any statement made or opinion expressed in its publications.

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PERSONNEL

THESE items are listings of the Engineering Societies Personnel Service Inc. This service, which cooperates with the national societies of Civil, Chemical, Electrical, Mechanical, Mining, Metallurgical, and Petroleum Engineers, is available to all engineers, members or nonmembers, and is operated on a nonprofit basis. If you are interested in any of these listings, and are not registered, you may apply by letter or resume and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular placement fee. Upon receipt of your application a copy of our placement fee agreement, which you agree to sign and return immediately, will be mailed to you by our office. In sending applications be sure to list the key and job number. When making application for a position include 8¢ in stamps for forwarding application. A weekly bulletin of engineering positions open is available at a subscription rate of $4.50 per quarter or $14 per annum, payable in advance. Local offices of the Personnel Service are at 8 W. 40 St., **New York 18;** 57 Post St., **San Francisco;** 29 E. Madison St., **Chicago 1.**

In addition to the listings below, ESPS maintains a more complete file of general engineering positions and men available. Contact nearest ESPS office, listed above.

MEN AVAILABLE

Mine Superintendent, mining engineering, age 32, married. Thirteen years mining experience from miner through superintendent; predominantly underground metal mining; excellent production record; adept at supervising and training indigenous peoples in safe and efficient underground practice. Foreign. M-624.

Mineralogist-Petrographer, M.S. degree. Experience petrographer. Training in spectroscopy and crystallography. Desires employment as petrographer and mineralogist. M-625.

Mining Engineer, B.E. degree, age 22, single. No actual experience except for vocational employment in Australian metal mines. Prefer South America. Presently located in New Zealand. M-626.

Geologist or Mining Engineer, Ph.B. degree, age 54. Eight years geologist and engineer with iron mining company, exploration, beneficiation and mine estimates; seven years civil engineering; eight years geologist in oil fields; two years seismograph. Any location. M-2257-Chicago.

Production Supervisor, Mine Engineer, Project Engineer, mining engineering, age 30. Nine years experience as miner, draftsman, surveyor, design engineer, shift foreman, applications engineer. Experienced in square set and room and pillar mining, blast hole drilling, report writing, mine plant and utilities design, construction and supervision of production personnel. Location open, would prefer West. M-2259-Chicago.

Civil-Mining Engineer, M.S. degree, age 34. Ten years plant engineering experience. Prefer Midwest or South. M-2260-Chicago.

Production Engineer, mining engineering, age 30. Seven years engineering experience in low cost metal and coal mining, development, construction, budgets, industrial studies, etc. Seeks opportunity for increasing responsibility. Location open. M-627.

Manager or General Superintendent-Mineral, mining engineering, age 37. Eleven years wide experience in milling and mining. Previously employed as a general superintendent. Good record of labor relations. Speaks Spanish. Prefer U.S. or foreign. Home: California. $10,000. Se-1883.

Geologist-Mine, mining engineer and registered P.E. in Canada, age 30. Six years exploration, mining development, production, organize and direct geology, plan program, estimate, supervise, interpret air and ground geophysical surveys, photogeology, property examination and valuation, diamond drilling, grade control for open pit and underground mining, ore reserves and grade statistics. Base metals and iron ore. Competent to assume technical, administrative and business responsibilities of a broad or challenging project. Any location. Home: Canada. $10,200. Se-850.

Geological Engineer-Metallics, Beryllium, Silver, M.A. degree in geology, age 32. Five years in geological exploration and mining in central Wyoming for the government and private industry. Familiar with resistivity and Gamma ray logging techniques, and geochemical exploration. Has conducted geologic property evaluation. Prefer western U. S. Home: California. $9000. Se-541.

Manager-Mining, mining engineering, age 32. Seven years in nonmetallic open pit mining in responsible supervisory positions. Desire management level responsibility. Prefer South, Midwest. Home: Nevada. $9000. Se-1127.

Geologist-Mining, degree in geology, age 34. Twelve years mining and exploration geologist, mine superintendent including administrative responsibility, superintendent of small mines, property acquisition, mine examination, ore grade and production control, sampling, mine financing, planning and execution of exploration programs, mine development and labor relations. Speak Spanish. Prefer western U.S. Home: Utah. $8400. Se-288.

Superintendent, Foreman-Mining, mining engineering, age 27. Almost five years experience in engineering and production phases of mining, including two years of open pit copper mining. Present position: mining engineer and assistant superintendent for a 2000-tpd underground limestone mine. Any location. Home: Virginia. $7200. Se-1280.

Mining, Geologist-Mine, mining engineering, age 29. Two years surveying, geological mapping, drafting, mine sampling, geochemical work, supervision of diamond drilling and mine development planning. Prefer California. Home: Washington. $6300. Se-1040.

Fire Protection-Industry, degree in geology, age 28. Recent graduate with four years drafting water facility maps part time. Two years part-time fireman. Prefer San Francisco area. Home: California. $5700. Se-816.

Senior Geologist, age 33, single. Fully experienced in all phases of exploration and mining geology in base metals, gold, uranium and asbestos. Desire position with consulting firm, exploration or mining company in western U.S. or west coast of Canada. M-628.

POSITIONS OPEN

Mining Engineer, with at least five years underground surveying and engineering for underground gas storage project. $9,000 to $10,000. East. W713.

Geologist, with eight to ten years experience in exploration, drilling and mine mapping for supervising and carrying out geological and drilling program of open pit iron ore operation. Iron ore experience desirable. Knowledge of Spanish. $6000 to $7200 after taxes. Housing provided. South America. F691.

Consulting Mining Engineer, to investigate the possibilities of reopening a gold mine in the Philippines. Salary open. F640.

Assistant General Manager, for eastern U.S. nonmetallurgical producing company, experienced in administration and labor relations. Upstate New York. W512.

Geologist-Mine, young. Graduate work or one year in mining or geology. Investigate, map formations and deposits, examine and report on property, identify minerals in lab, assist in reports and papers on geology, minerology, mining. For a state division. $530 to $584 a month, in San Francisco or Los Angeles. Sj-6408.

4½-yard P&H Electrics working at Craigmont Mines Limited's new mine near Merritt, B.C.

IF PURCHASES ARE ENDORSEMENTS...

P&H is the no. 1 choice of the mining industries

In recent years 68% of all American made 4.5 to 9 yard electric mining shovels bought for use throughout the world have been P&H

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1. **Higher rate of production** made possible by exclusive, patented P&H design principles of MAGNETORQUE® eddy-current hoist drive and Static Electronic Control. Both of these far-ahead design principles pioneered by Harnischfeger are the direct result of Harnischfeger designing and manufacturing its own electrical equipment—the *only* shovel manufacturer to do so.

2. **Vastly superior service and parts availability** reflecting our partnership of responsibility to you, the buyers of our products—a partnership of responsibility made possible by our *single source control* of electrical as well as mechanical components and their performance.

Your satisfaction with these advantages has made us The *World's Largest Builder of Full-electric Shovels.* Compare before you buy—write for complete information.

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BOOKS

Order directly from the publisher all books listed below except those marked • • • The books so marked (• • •) can be purchased through AIME, usually at a discount. Address Irene K. Sharp, AIME Book Dept., 345 E. 47 St., New York 17, N. Y.

The Impact of the Professional Engineering Union by Richard E. Walton, *Graduate School of Business Administration, Harvard University,* Soldiers Field, Boston 63, Mass., 1961, 419 pp., $5.00—The subtitle describes the book as a study of collective bargaining among engineers and scientists and its significance for management. It reports on research into the experiences of eleven companies where professionals have organized certified bargaining units. The three main sections discuss the impact on compensation, on personnel administration and on the engineering organization. An appendix gives a compilation of existing unions representing engineering and technical employees.

Handbook of Instrumentation and Controls edited by Howard P. Kallen, *McGraw-Hill Book Co., Inc.,* various pagings, $15.00—Data is presented to assist in selecting and effectively applying instruments and control systems for mechanical services in commercial, institutional and industrial buildings. After a study of fundamentals, the reader is provided with both qualitative and quantitative data on pressure, temperature, flow liquid level, pH and conductivity. This is then tied together in a detailed discussion of systems for boiler and power plants, heating plants, mechanical drives, air-conditioning, ventilation and refrigeration. Many control systems are completely illustrated to demonstrate modern practice. • • •

Metal Statistics 1961, American Metal Market, 18 Cliff St., New York 38, N. Y., 832 pp., $3.50, 1961—This 54th edition of the Little Red Book has the following new tables added to its contents: alloy steel production in U.S., alloy steel production by categories, fire refined and lake copper specifications, monthly shipments of steel mill products in U.S., world magnesite production, world production of bismuth and electric power in U.S.

Guide to Metallurgical Information: SLA Bibliography No. 3, *Special Libraries Assn.,* 31 E. 10th St., New York 3, N. Y., 1961, 96 pp., $4.00—This reference volume describes more than 600 books, journals and other information sources in the field of metallurgy. Updating Richard Rimbach's **How to Find Metallurgical Information,** published in 1936 and long out-of-print, this present work has extended its coverage to include societies, trade associations, research institutes, government agencies and technical services concerned with metallurgy as well as books, periodicals microforms, translations and theses. The scope is world-wide and emphasizes reference sources published in the last 20 years although some older material is listed.

Diesel and Gas Engine Catalog, 1961 Edition, 9110 Sunset Blvd. Los Angeles 46, Calif., 608 pp., $10.00—A substantially larger volume than the one issued in the previous year, this catalog describes and illustrates a considerably larger number of engines. Among its many divisions are those dealing with diesel engines, dual fuel engines, natural gas engines, gas turbines, heavy duty air compressors and instruments and automatic engine controls. The latter two divisions are included for the first time.

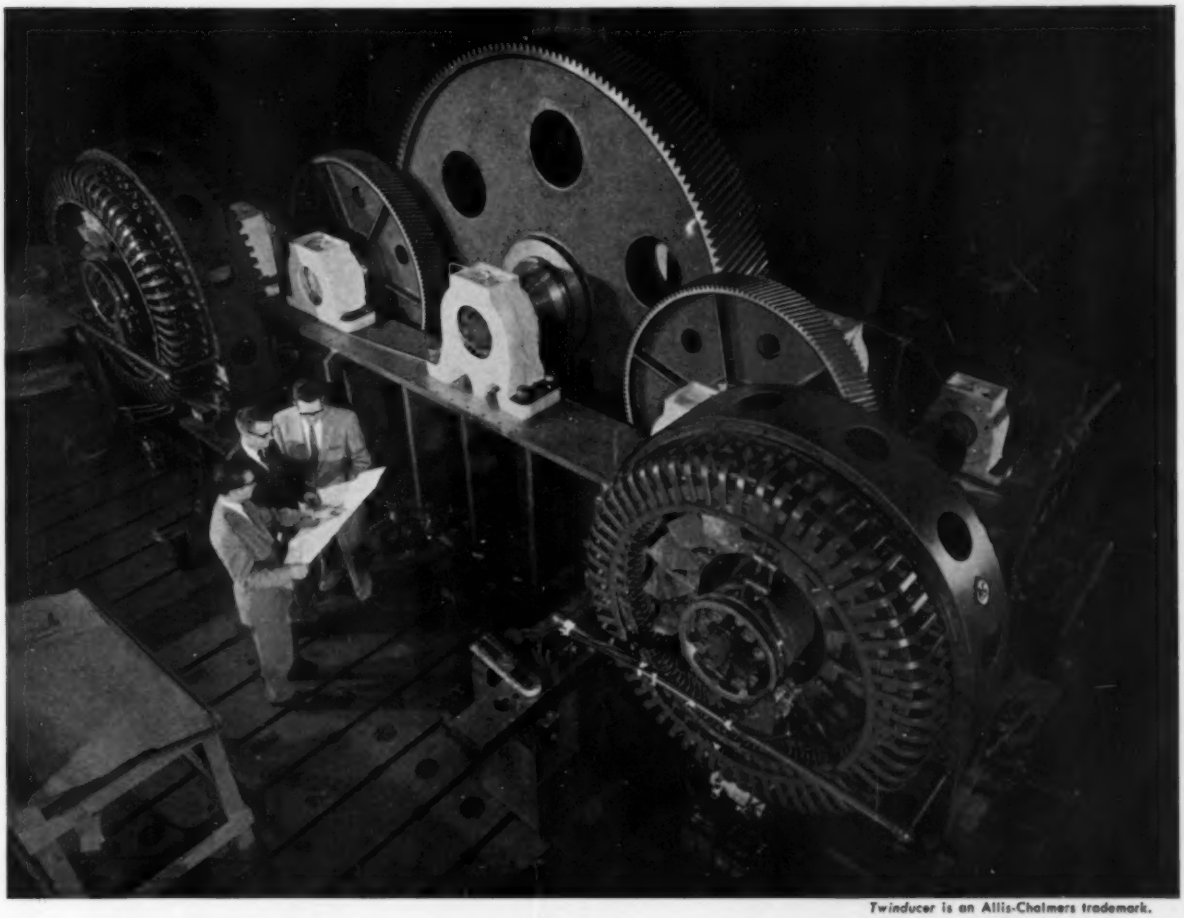
Water Treatment for Industrial and Other Uses by Eskel Nordell, 2nd Edition, *Reinhold Publishing Corp.,* 1961, 598 pp., $12.00—An extensive discussion of the conditioning and treatment of water supplies for industrial and domestic uses. The material in this edition has been considerably enlarged and rewritten with a view to including advances in the field and to clarify the presentation where necessary. Two new chapters have been added which deal with commercial and institutional water conditioning and with municipal water conditioning. The material dealing with silica removal has been rearranged in a more logical fashion. • • •

Der Porenraum Der Sedimente by Wolf V. Engelhart, *Springer-Verlag,* Berlin, Germany, 1960, 207 pp., approx. $12.00 (DM 48)—Beginning with a section on the determination and measurement of the porosity of sediments (sandy, argillaceous, carbonaceous), the author continues with a discussion of flow processes and diffusion through pore spaces, and the chemical composition and physical properties of fluids commonly occurring in sediments: saline solutions, petroleum and natural gas.

Optimum Use of Engineering Talent edited by Jerome W. Blood, *American Management Assn.,* 1515 Broadway, New York 36, N. Y., 1961, 416 pp., $9.00—Various phases of effective engineering management are discussed, from the basic objectives, responsibilities and organization of the engineering division to the re-

(Continued on page 1111)

ALLIS-CHALMERS



Twinducer is an Allis-Chalmers trademark.

Full-load demonstration proves 98%-plus efficiency of Twinducer grinding mill drive

New, twin-motor drive system divides mill load electrically, saves space and installation costs, extends gear-train life.

To show the high efficiency of the *Twinducer* drive, Allis-Chalmers engineers recently conducted a series of full-load demonstrations at the factory.

Full load was simulated by coupling two *Twinducer* drives. Driver unit was coupled to driven unit. Load on driven unit was two equally loaded generators.

Power input to the motors was measured, and compared with the output of the generators. Efficiencies (exclusive of ordinary motor and generator power losses) were found to range from 98.48% to 98.52% . . . more than twice the efficiency of most conventional mill drives.

The *Twinducer* drive balances the load electrically, through a unique, angular rotor shift of one motor. Result is a drive arrangement that takes less space than other trunnion drives . . . and facilitates automation of grinding equipment. *Twinducer* drive cuts maintenance costs, conserves power requirements and greatly extends gear-train life.

For complete information on the new *Twinducer* drive system, see your A-C representative. Or write **Allis-Chalmers,** Industrial Equipment Division, Milwaukee 1, Wis.

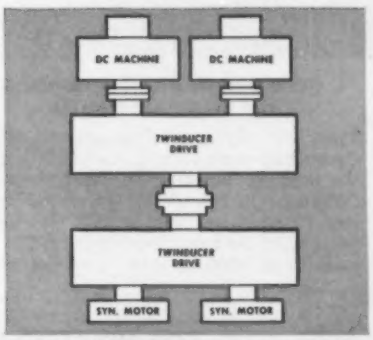


Diagram of Twinducer drive demonstration. Load is balanced electrically by a rotor shift mechanism in one of the twin synchronous drive motors. A-1514

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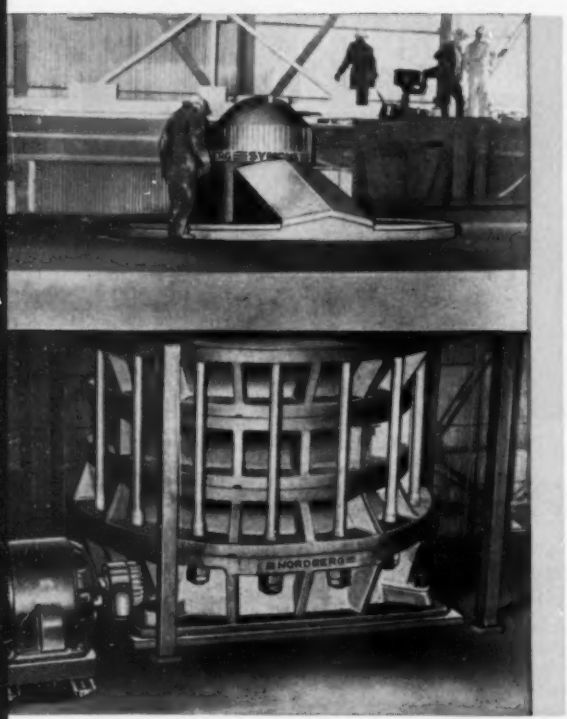
for reliable, low cost production of ORES and MINERALS



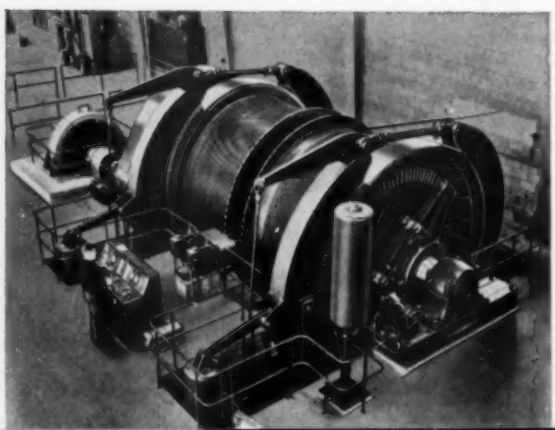
Your interest in lowering the cost, improving the quality, and raising the production of metallic and non-metallic ores and industrial minerals is a mutual interest which Nordberg has shared with the mining industry for 75 years.

This common interest and the many years of broad, yet intimate experience with the mining fraternity is reflected in the effectiveness and quality of Nordberg mining machinery. It is because of this background that Nordberg continues to lead in the design and construction of mining machinery which is *consistently first choice of the world's leading ore and mineral producers.*

SYMONS . . . a registered Nordberg trademark known throughout the world.

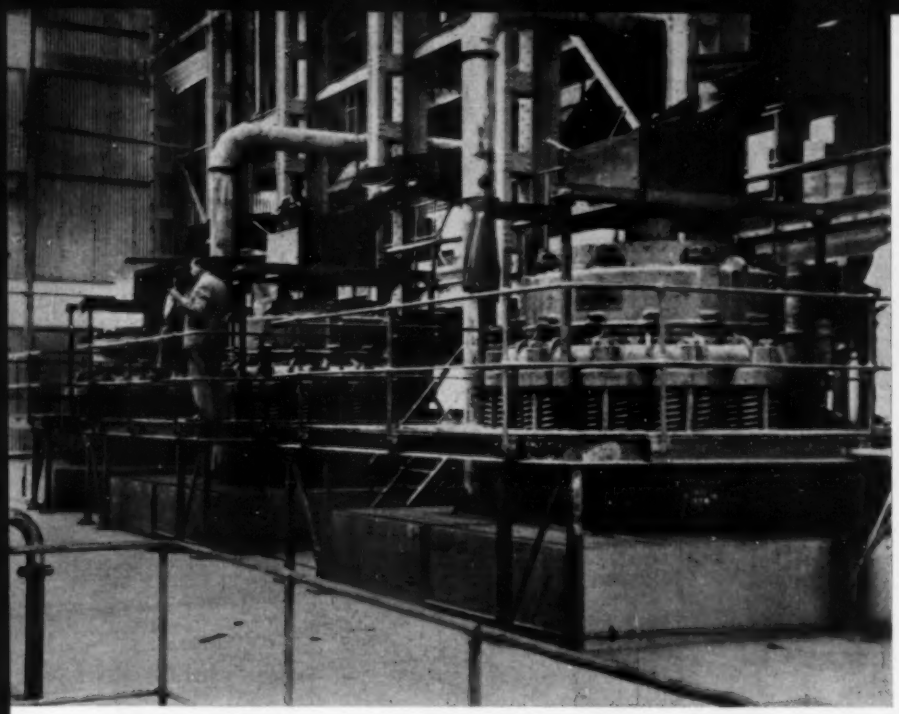
FOR PRIMARY CRUSHING OF MOLYBDENUM

This 60″ Symons Primary Gyratory Crusher has seen several years of service in the primary breaking of "moly" ores in Colorado. Other heavy duty Symons Gyratory Crushers are built with 30″, 42″, 48″, 54″ and 72″ feed opening widths and for capacities to 3500 or more tons per hour.



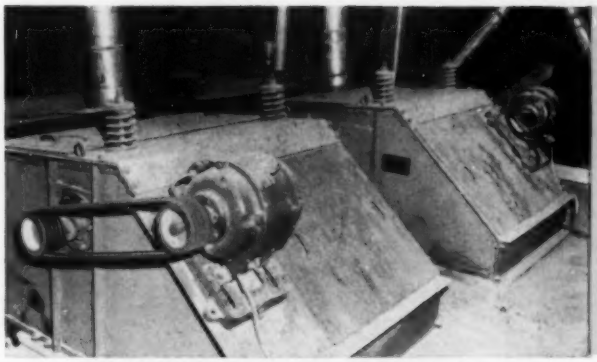
FOR HOISTING IRON ORE

Nordberg Mine Hoists for men and material are built in both conventional drum types as well as friction types . . . for push-button semi-automatic, fully automatic or manual control. Shown is a typical conventional double drum hoist.



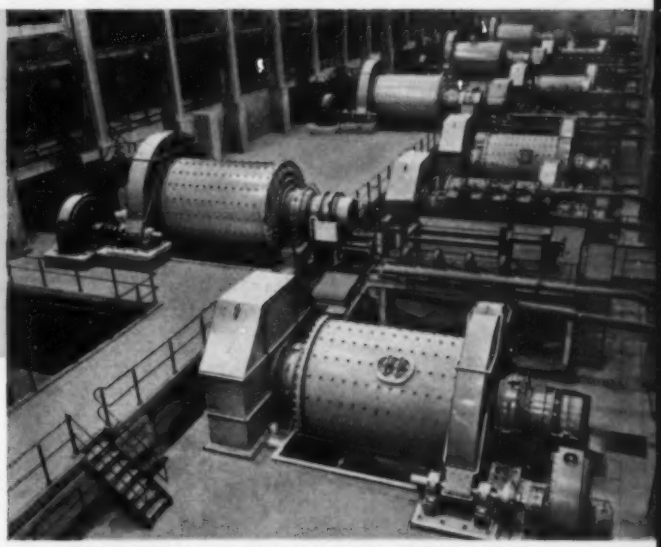
FOR FINE REDUCTION CRUSHING OF COPPER

These three Symons Cone Crushers are serving a Northern Rhodesian copper mine installation. Used for low cost, continuous production of quality products, Symons Cones are first choice of major producers the world over, in capacities to over 1500 tons per hour.



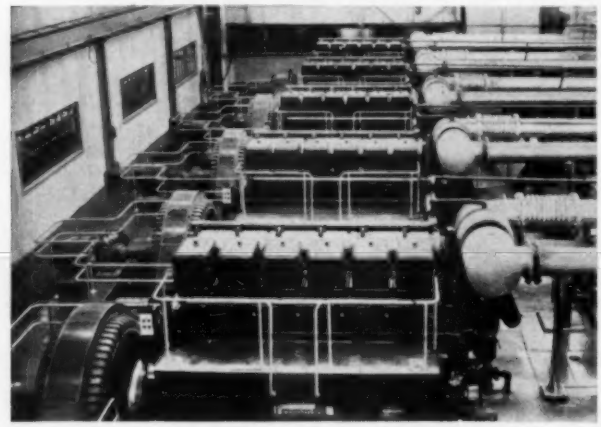
FOR SCREENING URANIUM ORE

These two 4′ x 8′ Symons Rod Deck Screens serve a large uranium processing operation in Canada. Other Symons Vibrating Screens are built in a wide range of types and sizes to handle numerous ore and mineral separation jobs from scalping to fine screening.



FOR GRINDING TACONITE

Shown are but a few of the many Nordberg Grinding Mills being used to reduce hard, abrasive taconite iron ore to the fineness of flour. Nordberg mills include Rod, Ball, Pebble, Tube and Compartment types, in sizes to 13′ in diameter and up to 50′ in length.



FOR POWER GENERATION

Nordberg 2-cycle and 4-cycle diesel, Duafuel®, and spark-ignition gas engines are reliably serving the mining industry in many parts of the world. Sizes range from 10 to over 12,000 hp in a single engine.

NORDBERG MANUFACTURING COMPANY • Milwaukee 1, Wis.

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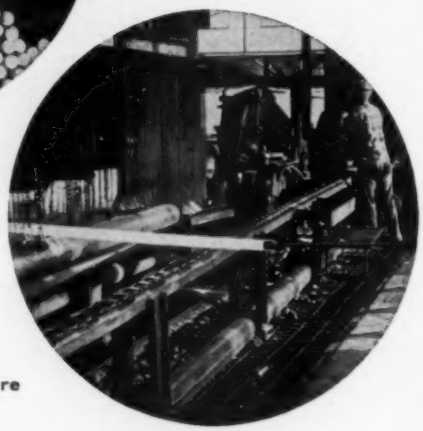
For further information, circle the following numbers on the reader service card: 6, Symons Primary Gyratory Crushers; 7, Mine Hoists; 8, Symons Cone Crusher; 9, Symons Screens; 10, Grinding Mills; 11, Engines.

MORE MILLING MILEAGE

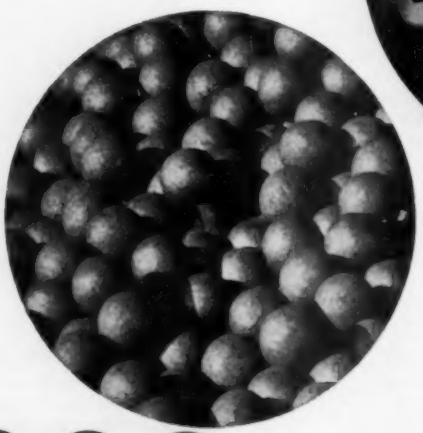


FOR YOUR MONEY—Coates Triple-Forged Carbex Grinding Balls will grind on and on in your mills turning out your product with greater efficiency, uniformity and economy. Coates Balls are built to be better . . . actual production tests proved they out-perform others costing much more.

Skill, quality materials, care and special equipment combine at Coates to make these rugged triple-forged grinding balls that offer *More Milling Mileage* . . . more profit to you. Bars of special formula, fine-grained, high-carbon steel are forged into perfectly round grinding balls that are tough to the core. Quality controls at every stage of manufacture assure that every Coates ball meets rigid specifications.

Get *More Milling Mileage* . . . improve your plant efficiency by specifying Coates Grinding Balls, precision products of proven performance.

CS61-5



Write for prices . . .
All sizes ½" to 5" carried in stock for immediate shipment.

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LARGEST EXCLUSIVE MANUFACTURER OF GRINDING MEDIA

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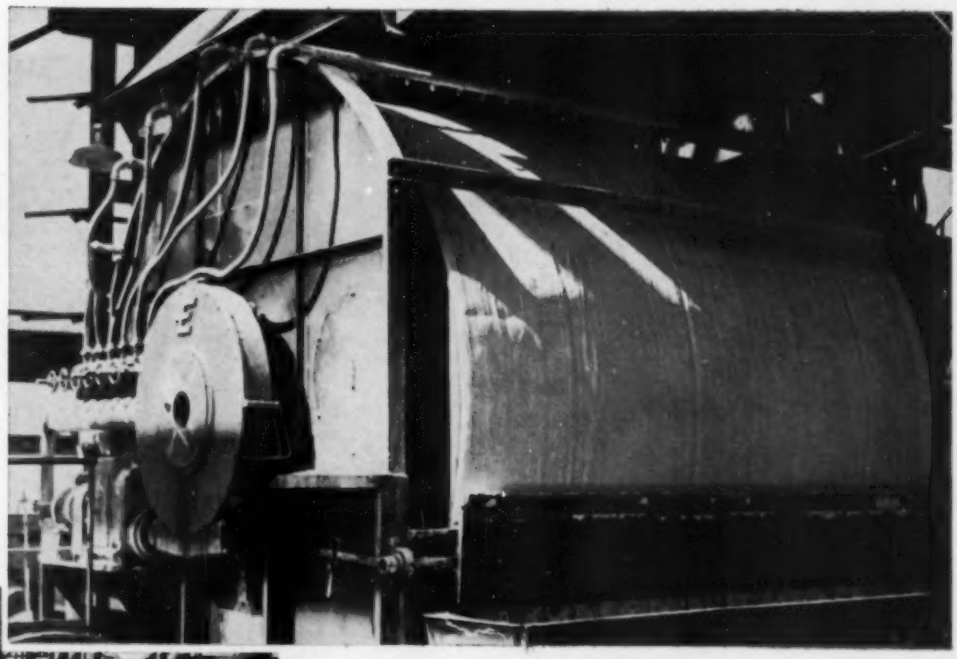
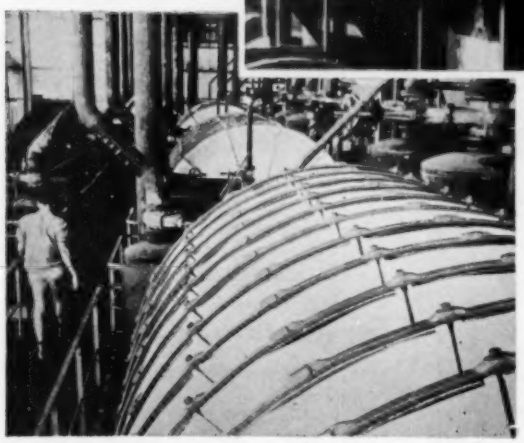
13 EIMCO Filters at FRIA





Handle Record Tonnages in New African Plant

FRIA, an organization owned by Pechiney, France; Olin, U.S.A., and several other European aluminum companies, operates one of the world's largest alumina plants in West Africa. The huge plant employs 13 Eimco filters.

A battery of 11½-ft diameter by 12-ft. Eimco drum filters dewater and wash final alumina tri-hydrate crystals. Each is equipped with special multiple wash headers, for highest washing efficiency, and streamlined Eimco Hy-Flow valves for handling an exceptionally high flow with negligible hydraulic loss. An E-Vac air sweep, built into each filter's hydraulic system, eliminates filtrate blow-back, assuring low cake moistures.

The high performance achieved by these filters is a result of cooperative engineering in pilot plant and design stages. FRIA and Eimco engineers worked as a team on equipment design, were guided by past experience in engineering equipment for similar difficult filtration problems.

For the FRIA process, seven 12½-ft. by 12 disc Eimco Agidisc filters were custom-designed for handling huge volumes of caustic liquor, in dewatering hydrate seed. Eimco Hy-Flow valves enable these filters to dispatch the required flow with minimum hydraulic loss.

Hy-Flow, E-Vac and Agidisc are trademarks of The Eimco Corporation.

Ask your nearby Eimco representative for details.

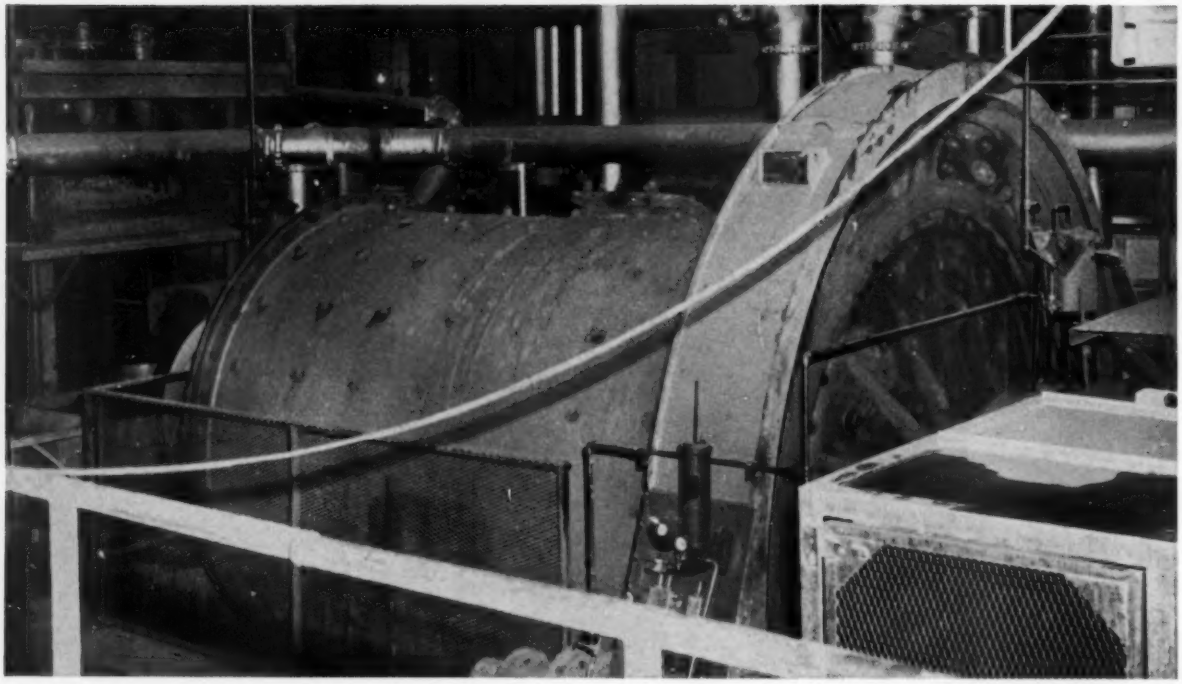
Write The Eimco Corporation,
Salt Lake City 10, Utah, U.S.A.
for Bulletin F-2049.

EIMCO
"Advanced Engineering and Quality Craftsmanship Since 1884"

B-845

For further information, circle the following numbers on the reader service card: 14, Hy-Flow; 64, E-Vac; 65, Agidisc.

Anaconda Selects Marcy Mills for its modernization program



One of three new 9′ x 14′ Marcy Ball Mills at Anaconda

Photo courtesy Mining World.

Anaconda Reduction Works, Anaconda, Montana, has an extensive modernization program to improve metallurgical results and reduce costs.

This program includes a regrind stage on rougher flotation concentrates and the company selected three 9′ x 14′ Marcy Ball Mills for the job.

Anaconda Has Purchased More Than 70 Marcy Mills

During the past 30 years Anaconda and its subsidiaries have purchased a total of more than 70 Marcy Ball and Rod Mills . . . evidence of the efficient and economical operation of Marcy Mills.

We want a chance to ask **YOU** for **YOUR** order . . . by having an opportunity to show you how **YOU** can improve metallurgy and reduce costs with Marcy Mills. We invite your inquiry by letter, wire or phone.

The Company that cares enough to give you the best!

Manufacturing Division

MINE AND SMELTER SUPPLY CO.

DENVER 16, 3800 RACE ST. · NEW YORK 17, 122 E. 42nd ST. · SALT LAKE CITY 1, 121 W. 2nd S. · EL PASO, 1515 11TH AVE. · ALBUQUERQUE, 701 HAINES N.W.

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BOOKS

(Continued from page 1104)

cruiting and selection, compensation, supervision, professional development and evaluation of engineers. A special group of case studies describes the engineering organizations of IBM, Carborundum and Convair.

• • •

Sciences in Communist China edited by Sidney H. Gould, *American Assn. for the Advancement of Science*, 1515 Massachusetts Avenue, N.W., Washington 5, D. C., 1961, 884 pp., $14.00 ($12.00 to AAAS members)—This volume contains the papers of a symposium presented at the New York meeting of the American Assn. for the Advancement of Science, December 26-27, 1960. Twenty-six papers were presented under six headings: *Science and Society, Biological and Medical Sciences, Atmospheric and Earth Sciences, Mathematics and the Physical Sciences* and *Engineering Sciences and Electronics*. Except for the paper on geophysics by J. Tuzi Wilson, who visited both Communist China and Taiwan, all of the material presented is based on Chinese scientific literature available in this country. The general impression left by the articles is that, in basic research, China has not yet caught up to the Western world because, at present, the Chinese are devoting themselves to technology and instruction in order to reach the Western level of proficiency in these two respects by the end of their 12-year plan in 1967.

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IC 7988 Tentative Safety Recommendations for Field-Mixed Ammonium Nitrate Blasting Agents. (Reprint)
IC 7995 Testing and Splicing Electric Cables and Frame-Grounding Pit Equipment, Tecumseh Coal-strip Mine, Boonville, Ind.
IC 8001 American Standard Practice for Rock-Dusting Underground Bituminous Coal and Lignite Mines to Prevent Coal-Dust Explosions.
IC 8008 Coal Research Organizations: Their Activities and Publications.
IC 8019 Use of High-Expansion Foam on a Pennsylvania Coal-Mine Fire.
IC 8021 Dust Control in Mining, Tunneling, and Quarrying in the United States, 1955 through 1957.
IC 8031 Recommended Procedures for Mine Hoist and Shaft Installation, Inspection, and Maintenance.
IC 8038 Developments in Waterflooding and Pressure Maintenance in Osage County, Okla. Oilfields, 1961.
Mineral Trade Notes Vol. 51, No. 1.
MMS 3179 World Mineral Production in 1959.

ABSTRACTS

In This Issue: *The following abstracts of papers in this issue are reproduced for the convenience of members who wish to maintain a reference card file and for the use of librarians and abstracting services. At the end of each abstract is given the proper permanent reference to the paper for bibliography purposes.*

Selective Maintenance Pays Dividends at the Ireland Mine by *L. S. McNickle, Jr.*—The application of selective maintenance to the Ireland mine is discussed with emphasis on the beneficial aspect in scheduling maintenance before a crash program is needed. Proper maintenance records, good replacement parts and well trained maintenance men are essential to this program. **Ref.** (MINING ENGINEERING, **October 1961**) **p. 1146.**

Copper Segregation Process Shows Promise at Lake Shore Mine by *G. A. Freeman, Carl Rampacek* and *L. G. Evans*—A segregation process to concentrate ore not amenable to conventional flotation concentration or sulfuric acid leach treatment is described, and findings are given for pilot plant results over a six-month period. **Ref.** (MINING ENGINEERING, **October 1961**) **p. 1152.**

Electromagnetic Studies of Iron Formations in the Lake Superior Region by *F. C. Frischnecht* and *E. B. Ekren*—The authors report on experimental electromagentic studies carried out by USGS during the summers of 1957 and 1958 over several iron formations in the Lake Superior region. The principal objectives were to evaluate electromagnetic methods for locating directly the oxidized iron ores, to test electromagnetic methods of tracing taconites that are known to have high electrical conductivitiy and to determine if electromagnetic methods could be used to estimate the magnetic susceptibility and, consequently, the magnetite content of magnetic strata. Results varied with location. A variable-frequency electromagnetic technique tested on the Gogebic Range showed promise of being a practical method for distinguishing between magnetic taconite, having high electrical conductivity and high magnetic susceptibility, and graphite slate having high electrical conductivity, but low susceptibility. This technique was used in estimating the magnetic susceptibility and, consequently, the magnetite content of magnetic strata. **Ref.** (MINING ENGINEERING, **October 1961**) **p. 1156.**

Amsco makes dippers as original equipment for most leading power shovels. Other power shovel accessories include dipper lips, fronts and doors, racks, bevel gears, crawler shoes sheaves, sprockets, idlers, shipper shaft pinions.

Amsco manganese steel, "The toughest steel known," is used in this gyratory crusher mantle and concaves. In some cases, new Amsco manganese moly alloys can result in more time between crusher shutdowns. Ask your manufacturer about these special alloys.

For further information, circle the following numbers on the reader service card: 17, Dippers, Power Shovel Accessories; 18, Manganese Moly Alloys; 19, Dredge Pumps, Accessories; 20, Simplex Dipper Teeth; 21, "Pair for Wear," Nicro Mang.

WHERE WEAR IS A PROBLEM

look to AMSCO for the answer

Building wear resistant parts for your machinery can be handled in one of two ways.

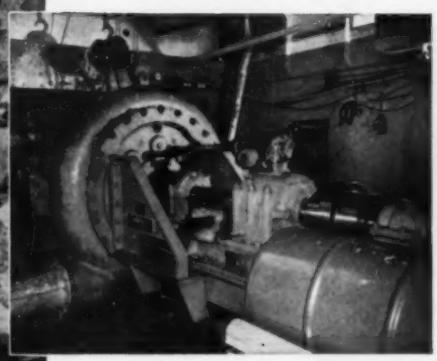
First, parts can be "beefed up" to make them heavier and larger.

Second, superior metallurgy can be applied to make parts tougher and stronger without increasing weight.

A "beefed up" part will probably last longer simply because there is more metal to wear away. But, consider a jaw crusher. Heavier, larger parts impose strains that bearings and framing members were not designed to take. A heavier jaw means a restricted opening that actually *cuts* production.

Amsco works with original equipment builders to design parts that make the entire machine operate as it was designed to do. In addition to manganese steel (12-14% manganese), special alloys have been developed to meet your specific needs, such as, chrome-moly steels, multiple alloy engineering steels and high chromium and nickel iron.

Your nearby Amsco representative or your equipment dealer will analyze your operation and recommend an Amsco alloy product that will produce or move material at the lowest operating cost per ton. Amsco products pay for themselves through reductions in replacement and maintenance.



Amsco dredge pumps aren't "sold off the shelf." Each one is custom engineered to a specific application to make certain it will give the longest, most trouble-free life for the conditions it will encounter. Dredge pump accessories include swing sheaves, cutterheads, flap valves, elbows, hose nipples and hand hole nipples for every condition of impact and abrasion.

Simplex* two-part reversible dipper teeth stay sharp after competitive teeth have *worn out completely.* Reversing for extra life takes only a few minutes. Simplex design plus a new dipper tooth alloy is saving dipper tooth replacement costs wherever shovels are used. Try replacing half your dipper teeth with Simplex and measure the difference under your own job conditions.

Fast build-up, repair and hardfacing are features of Amsco electrodes and weldments. Send for your sample kit containing our famous "Pair for Wear"—Nicro Mang* for all manganese welding or replacing a buttering pass of stainless when welding manganese steel to carbon steel and X-53 for all-purpose hardfacing. These two rods handle 90% of build-up and hardfacing jobs.

*TRADEMARK REGISTERED

They're backed by experience...

AMERICAN Brake Shoe COMPANY

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IN CANADA: Joliette Steel and Manitoba Steel Foundry Divisions
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Welding products distributed in Canada by Canadian Liquid Air Co., Ltd.

AMSCO

AMERICAN MANGANESE STEEL DIVISION
CHICAGO HEIGHTS, ILLINOIS

6181

DOZING PACEMAKER IN HIGH GEAR

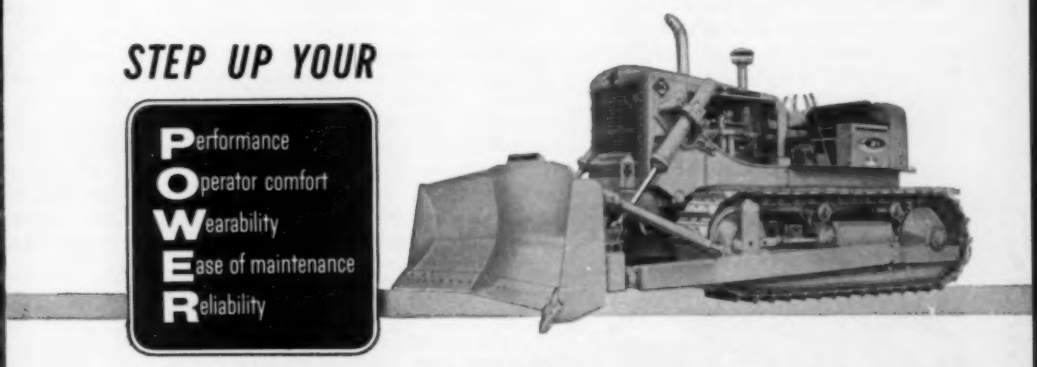
For stripping overburden, the Allis-Chalmers HD-21 with wide range transmission is in a class by itself. This tractor moves bigger loads over a wider speed range, than any other machine in its price range.

Ever stop to think about the difference just 1 or even ½ mph can make on long stripping operations, pioneering, road maintenance and cleanup work? For example, an Allis-Chalmers torque converter HD-21 averaging 3 mph dozes 60 miles every time a comparable-sized machine averaging 2.5 mph dozes 50.

And you'll get this speed advantage with an HD-21 on jobs like those above that you can handle in this tractor's wide range high gear. It gives you a speed spread of 0 to 6 mph. Using only this gear, the operator can do more work in the 1.75 to 4.5 mph range than comparable units can do in three gear ranges. And for heavy dozing, the HD-21's low gear gives this tractor the big load power in the 1-to 2-mph range.

But it's more than just raw speed that makes the HD-21 a big-production dozer. It's stability with the long track that smooths out tractor bounce. It's fast acceleration with the best engine-torque converter combination in the industry. It's precise control with quickly responsive levers and a tight-fitting, close-coupled blade. At top mph, the HD-21 dozer can hold a level grade which "sloppy" dozers can't begin to match even at slow speeds. It's all these things that add up to low-cost dirt.

Your Allis-Chalmers dealer is confident that the HD-21 will give you more for your dozing dollar — not only with the workingest high gear, but also long-life oil steering clutches and brakes, the toughest track ever built . . . the industry's healthiest engine, certified permanent lubrication of truck wheels, unit construction for easiest maintenance. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.



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POWER FOR A GROWING WORLD

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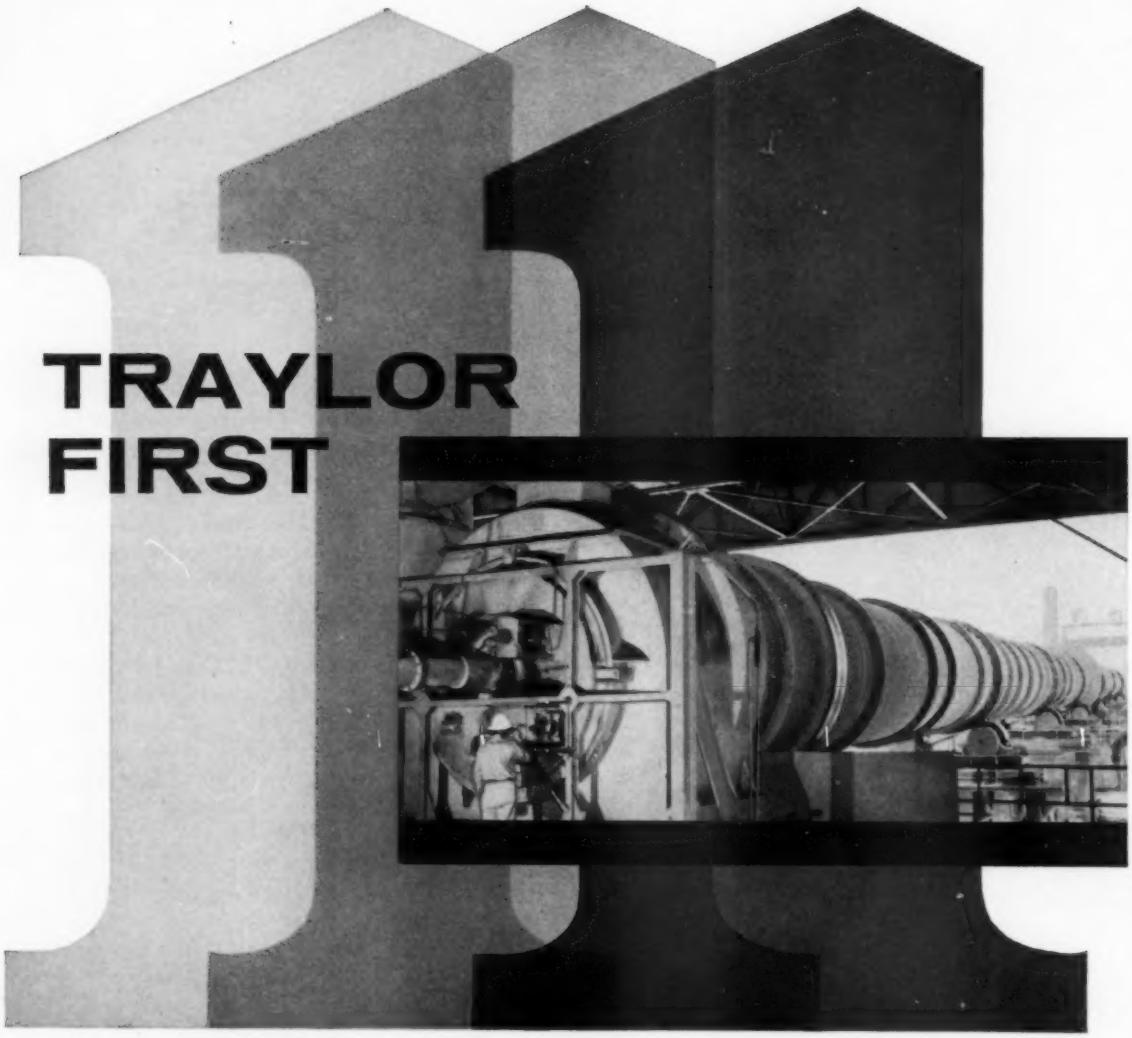

Why this 1933 first welded kiln could be the key to your company's profits in the 60's

For the simple well-proved reason that they're better, kilns of all-welded construction are pretty much "standard" today. Important to keep in mind: the standard was set by Traylor . . . builder of the first welded kiln in 1933.

A radical innovation a generation ago —but why so important now? First and obviously, it means that Traylor has the longest record of experience in this special kind of equipment.

More important still: It's merely one example of Traylor's coming up first with new ideas to meet changing needs. Benefits of other Traylor "firsts"—some dating before 1933, many since—are being reaped today throughout the industry, quite likely already including your own plant. Traylor built, for example, the first 60-inch primary gyratory crusher and the first large ball mill.

Today Traylor's proved capacity to pioneer sound innovations in kilns, mills and crushers is enhanced by expanded research capabilities and process know-how.

Up-to-date facilities and a long, impressive record of past "firsts" are a good combination of reasons to call on Traylor first when you're planning for efficient operation in the changing business climate of the sixties.

See Pit and Quarry Handbook for details and specifications.

Traylor

TRAYLOR ENGINEERING & MANUFACTURING

DIVISION OF FULLER COMPANY

1534 MILL STREET • ALLENTOWN 1, PA.

4492
TKA-15

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ADVERTISEMENTS as well as items mentioned in "Products for Mine and Mill" and "Data for Mine and Mill" are especially numbered for your convenience. For additional information on all products, circle the appropriate numbers on the cards below . . . fill in requested information . . . mail card today!

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PHILADELPHIA 1, PA.

KW-DART TRUCKS HELPED MAKE TOQUEPALA 125 MILLION TONS DEEP

This year's repeat order for 30 more KW-DART trucks is proof of performance on a tough job!

In 1956, Southern Peru Copper Corporation purchased the first of a total of 75 twenty-five ton capacity KW-Dart trucks to be used in the development of its 237-million-dollar copper mine at Toquepala, Peru, South America.

Toquepala's ore-body lay under 125 million tons of waste material, which had to be removed as economically as possible. It was a staggering task—but the KW-Dart trucks measured up. Result: This year—KW-Dart received a repeat order for 30 thirty-seven ton capacity trucks for continued operations at Toquepala.

For information on how custom-engineered KW-Dart rock and ore movers can bring fast-cycling capacity and economy of operation to *your* job, write:

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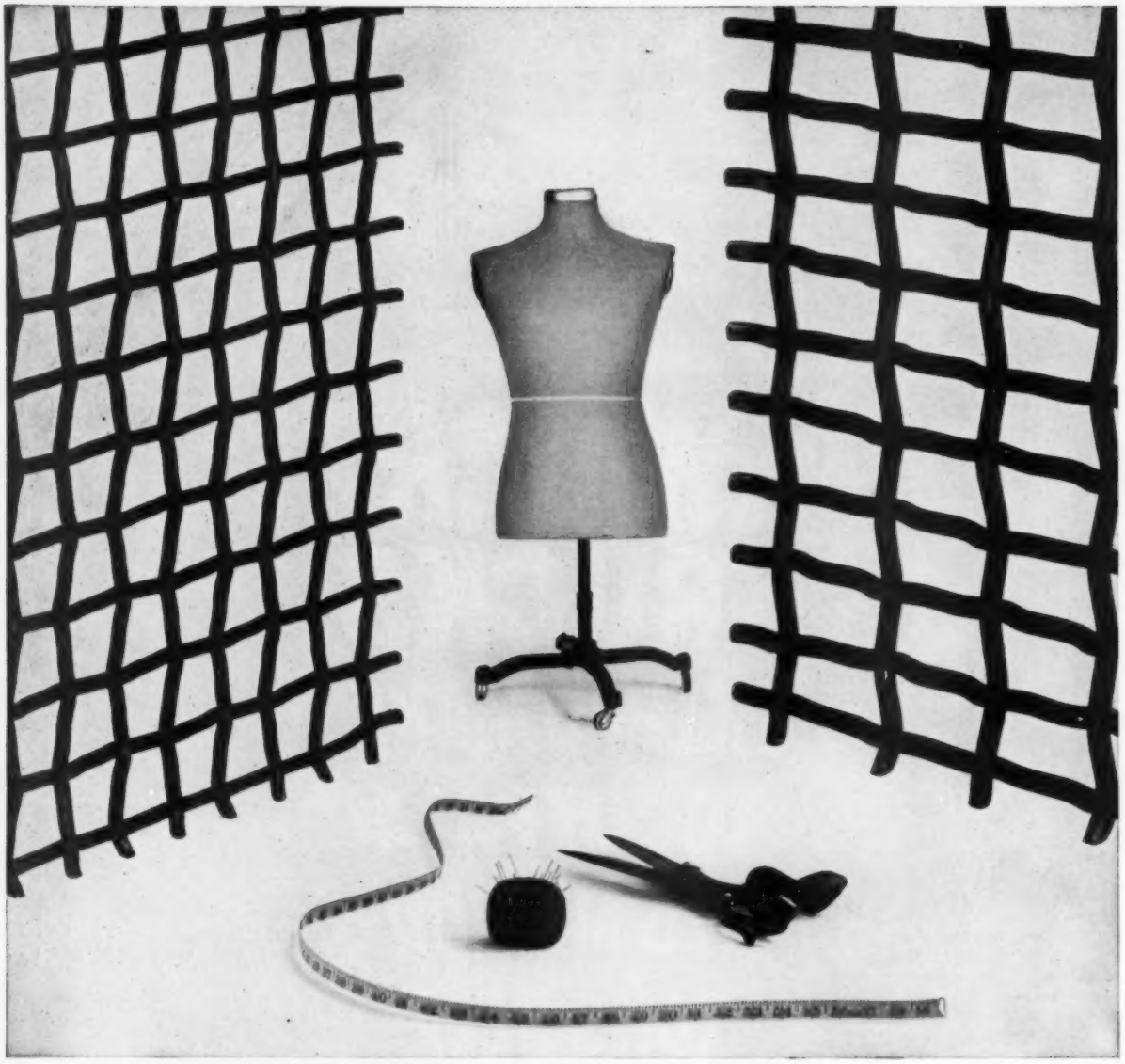
KW-DART TRUCK CO.

1301 North Manchester Trafficway, Kansas City 20, Missouri, U. S. A.



Tailor-made to fit your needs... CF&I Space Screens

Space screens are like suits — they not only have to be the right size, but they have to wear well, too. That's why CF&I Space Screens are your best buy.

To make sure that you get a screen that fits your operation perfectly, CF&I produces virtually every size and type of weave. If one of our standard screens won't do the job, we'll be glad to tailor-make a screen to your exact specifications.

To assure you a screen that "wears like iron," CF&I uses only the finest quality steel wire and weaves it on giant hydraulic looms. This produces tight wire intersections so that the screens will retain their size and shape of openings under the most punishing vibration and abrasion.

The result is a screen that is more economical because it cuts your equipment downtime and lowers the cost-per-ton of material screened.

Your CF&I representative will be glad to study your operation and recommend the screen that best meets your requirements. Call him today.

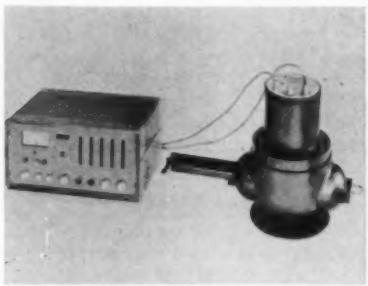
The Colorado Fuel and Iron Corporation
Denver • Oakland • New York
Sales offices in Key Cities

Circle No. 25 on the reader service card.

PRODUCTS
FOR MINE AND MILL

Berylometer

A berylometer for laboratory use has been developed by *Research Chemicals, Division of Nuclear Corp. of America.* The unit (Model BEL 100B) includes a five-decade scaler, detector head and a lead castle. The sample is placed in a container and inserted into the sample slide. Gamma rays from the source (antimony 124) interact with the sample, giving off neutrons which are captured in the scintillation phosphor which gives off a light photon. The photon strikes the photo cathode of the photo-multiplier, resulting in an electrical pulse which is connected. By comparing the



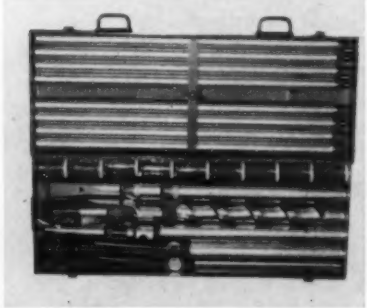
count rate of a known sample, the beryllium in an unknown sample can be determined. **Circle No. 76.**

Sump Pump

A self contained, portable pneumatic sump pump for the removal of sewage, sludge, chemicals, oil or water from sumps, wells, excavations, mines, etc. has been announced by *Schramm, Inc.* The pump is 19⅜ in. high and can be passed through a hole as small as 10x12 in. Liquids over 1⅜-in. deep can be picked up; solids over ¾-in. are blocked out by an integral bronze strainer. Pump speeds range from 3200 to 3600 rpm, depending on the head against which it is pumping and the supplied air pressure. **Circle No. 77.**

Soil Exploration Kit

The Testlab Corp. has made available a soil exploration kit that is designed for hand operation. It is contained in a metal carrying case weighing 156 lbs, but for increased portability, it is also available in two 70-lb canvas rolls. The unit consists of ten different earth and soil sampling tools adequate for sampling to depths of 20 ft. **Circle No. 78.**



Diamond Drill

The Longyear "38" diamond drill, now being manufactured by the *E. J. Longyear Co.*, features an eight-speed transmission with spindle speeds of 69 to 1850 rpm with engine running at 220 rpm. Special low-range speeds permit efficient casing rotation, rock bitting, soil sampling and other applications requiring slow rotation speeds. Capacity of the "38" is 2800 ft with AW rods or 1750 ft with NW rods. Other features include 3-in. hydraulic swivel head or optional screw-feed swivel head, independent hoist clutch and brake, high-speed chuck runback, angle hole mast, hydraulic retraction and self-propelling attachment. **Circle No. 79.**

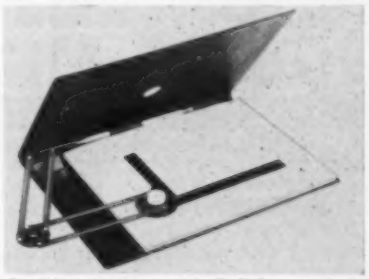
Gas Masks

A new line of gas mask respiratory protection has been introduced by *Mine Safety Appliances Co.* Featured in the series is a seamless,

leakproof canister. The canister is equipped with a high-efficiency toxic dust filter which, together with the appropriate chemical fill, permits its use in atmospheres containing both gaseous and particulate contaminants. Color coding of the canister meets identification requirements of the American Standards Association and the USBM. The light-weight face piece, available with the new gas mask line, provides excellent visibility, a speaking diaphragm for clear communication and room for prescription spectacles. The "Maskfone," a sound-powered communications system suited for remote operations, can also be adapted to the new face piece. **Circle No. 80.**

Drafting Kit

A portfolio sketch kit with portable drafting machine mounted in a self-locking binder has been announced by *Draftette Co.* The kit includes a



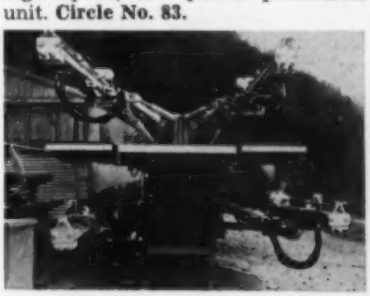
drafting instrument, 3x5-in. or 4x6-in. scale and 180° protractor, and 8½x11-in. drawing paper. It measures 9½x13½ in., weighs 1½ lbs. Price: $8 with the small scale; $9 with larger scale. **Circle No. 81.**

Ultra-Violet Light

A compact long and short ultra-violet kit adaptable for field or laboratory use has been introduced by *Ultra-Violet Products, Inc.* Priced at $19.95, the kit includes long and short wave ultra-violet lamps which operate on 110 v or, when kit is used portably, on 6 v. A power pack adapter ($14.95) is also available for use with this unit. **Circle No. 82.**

Rotary Percussion Drill

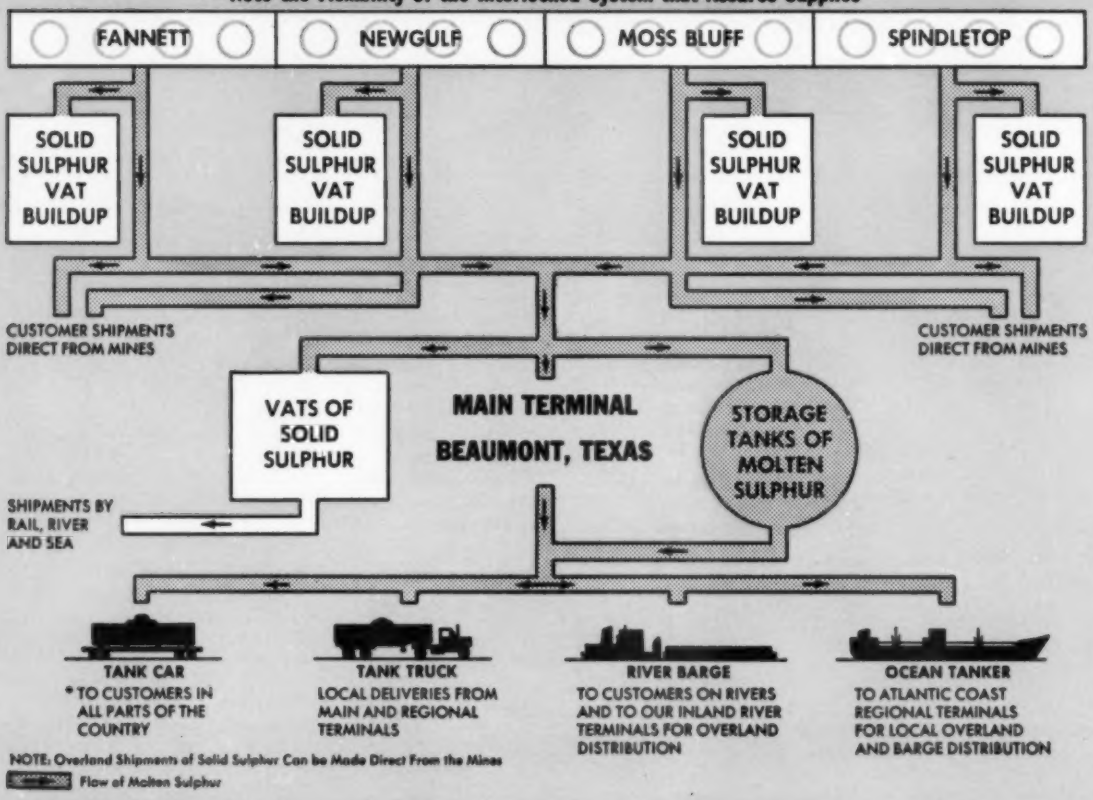
Joy Mfg. Co. has introduced a rock drill which combines features of rotary and percussion drilling. This rotary percussion drill, best suited for tunneling and underground mining operations, can drill 16-ft holes of 1¼ to 1¾ in. diam. Larger and deeper holes may be drilled in some formations. Rotary cutting is provided by an independent rotation system which applies high torque to the bit through a variable speed hydraulic motor and gear reduction. The percussion action comes from a high speed, free-piston percussion unit. **Circle No. 83.**



molten sulphur

HOW TGS MOLTEN SULPHUR TRAVELS FROM FRASCH MINES TO CUSTOMERS

—Note the Flexibility of the Interlocked System that Assures Supplies—



Flexible Facilities to meet a Growing Demand

The rapidly growing demand for deliveries of sulphur in molten form—and it is coming from all parts of the country—is well-answered by the flexibility of our production, storage and distribution facilities.

Here, graphically, is the way TGS Molten Sulphur moves from the four Frasch Process producing areas in Texas to customers. Unusual flexibility enables us to do several things simultaneously. We can fill orders direct from the mines, build up inventory at our main terminal in Beaumont, Texas, ship to customers from this main terminal or supply our regional terminals.

We maintain steady production schedules at all properties. With flexible storage, shipping and delivery facilities of not only molten sulphur but solid sulphur, we are in a strong position to serve the sulphur-consuming plants all over the United States and Canada. Our sulphur recovery plants (from natural gas) in Wyoming and Alberta take care of the demand in northwest United States and Western Canada for both molten and solid sulphur.

TEXAS GULF SULPHUR COMPANY
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811 Rusk Avenue, Houston 2, Texas
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Circle No. 26 on the reader service card.

MINE DEVELOPMENT REPRINTS: *The Eimco Corp.* has available a limited supply of reprints of the engineering summary prepared by *Loraine Gold Mines, Ltd.* of a record-making drift development in Africa. The 18-page engineering summary includes ten detailed drawings, full descriptions of headings, water control, working procedures and ventilation maintenance and performance achievements, utilizing the Eimco 40 track-mounted loaders which were used in each heading. During one month, total footage was 2695 ft, with 28,948 tons excavated. For a free copy, write directly to The Eimco Corp., P.O. Box 300, Salt Lake City 10, Utah, and request "Loraine Gold Mines, Ltd. Reprint."

(101) CONTROLLED LIQUIDS AND SOLIDS FEEDING: *B-I-F Industries* has just released a comprehensive bulletin on feeding, weighing, blending and proportioning equipment for the controlled feeding of liquids and solids in process industries. Process control, involving either a single unit or a fully integrated system, can be applied to handle materials ranging from soda ash and industrial alcohols to liquid latex, carbon black and rocket propellants. The continuous feeding and blending of liquids feature such products as the Proportioneers pumps for volumetric feeding of toxic, explosive or corrosive liquids and suspensions; the Omega Rotodip for wide-range feeding of slurries, low viscosity or corrosive liquids; the Proportioneers Blendamatic; and Two Component Blenders for continuous, in-line blending of components without intermediate mixing or storage.

(102) "ECONOMICS OF THE V-BAND COUPLING" is a 16-page booklet issued by the *Marman Division* of *Aeroquip Corp.* This booklet (No. SDP-2) gives specific cost comparisons between V-bands and other joining methods. It also explains how many of the "hidden costs" of manufacturing can be reduced by using V-band couplings. Savings in weight and installation or assembly time are examples of other types of economies illustrated in the booklet. Adaptability of design is also discussed for manufacturers of filters, separators or containers.

(103) "PUMP FUNDAMENTALS," a 16-page booklet available from *Goulds Pumps, Inc.*, gives an elementary outline of the characteristics, operation and selection of reciprocating, rotary and centrifugal pumps. Non-technical, it is of primary interest to students, and those in industry who desire a basic knowledge of pumps. Emphasis is placed on centrifugal pumps because of wide use of this type. Definitions, basic formulae, examples and miscellaneous data frequently used in pump application are included in this informative brochure.

DATA
FOR MINE AND MILL

(104) BALL VALVES: A four-page brochure describing the line of Econ-o-miser ball valves is now available from the *Worcester Valve Co., Inc.* to enable users to select the correct size and combination of metals, seals, seats and pipe ends. In addition to illustrating the patented features of this ball valve, five types of pipe ends (flanged, screw end, socket weld-butt, weld or welded-in-nipple) which can be used with the Econ-o-miser are shown. A cost comparison between a standard ball valve, a standard gate valve and the Econ-o-miser is also given.

(105) CARE AND HANDLING OF ROCK DRILL STEEL: A humorously illustrated, 32-page booklet titled, "Hand in Hand", covering the care and handling of rock drill steels, is being offered by *Atlas Copco, Inc.* Sample illustration is shown below.

(106) ALIPHATIC ORGANIC CHEMICALS: A catalogue of aliphatic organic chemicals produced by *Armour Industrial Chemical Co.* lists some 150 different products along with specifications and typical applications. The 12-page booklet covers the company's fatty acids, amines, diamines, acetates, quaternary ammonium chlorides, nitriles, amides, ethoxylated chemicals, fuel oil additives, anti-caking and anti-dusting agents as well as acid corrosion inhibitors.

(107) BY-PASS ROTAMETERS: How measurement and control of flow rates in pipe sizes as high as 48 in. can be done economically is described in By-Pass Rotameter Bulletin No. 116 issued by *Brooks Instrument Co., Inc.* The bulletin has been prepared especially for engineers and designers who want complete information about capacity determination, flow range data, piping requirements, accuracy and other engineering details concerning the use of rotameters in by-pass arrangement.

(108) "CAN THE RESEARCH SCIENTIST ACQUIRE A MANAGEMENT ATTITUDE?" is the title of, and the basic question underlying, an interesting printed discussion now being offered by *Battelle Memorial Institute* to representatives of industry concerned with research and development. In this booklet, M. R. Nestor, author of the booklet and Battelle's manager of project development, contends that industrial management people and research professionals have much in common, including a high degree of creativeness. He asserts that industry's practical needs and the professional's desire for creative freedom are compatible. Case histories are cited in which the research professional's suggestions for work in areas not previously considered are applauded by management men responsible for their company's research and development activities. The Battelle spokesman reports that the average research professional wants to see the results of his work applied to industrial production and social betterment, and thus acquires a sense of economics and will not recommend proposed research projects if technological and market factors indicate that the research effort will not fill a real need.

(109) CHEMICAL EQUIPMENT Their wide range of specially engineered equipment for the chemical process industries is briefly described in a four-page bulletin from *Industrial Filter & Pump Mfg. Co.* Designated GEN 61, the brochure describes and illustrates such items as pressure filters, ion exchangers, demineralizers, water softeners, centrifugal pumps, heat exchangers and waste treatment systems.

(110) DIGITAL PROCESS CONTROLLERS: The *Dynapar Corp.*, subsidiary of *The Louis Allis Co.*, has published Bulletin No. 201-A on digital process controllers for industrial counting, measuring, indicating and control applications. Designed for high speed industrial requirements, the process controllers count pulses from all types of sensing devices and control various functions of other equipment when a preset count is reached. They provide a range of 0 to above 180,000 counts per minute with instantaneous reset as standard, and optional ranges to 75,000 counts per second with instantaneous reset.

Photos slightly reduced

NI-HARD mill liners

...good to the last ¼"*

Original liner 3¼" minimum thickness. Worn to ¼" before replacement. No breaking. No cracking. Outlasted unalloyed white iron 2.15 to 1 and manganese steel 1.46 to 1

MILL LINER MINIMUM THICKNESSES

If you are unacquainted with Ni-Hard** mill liner segments, the table below will give you a rough guide to the minimum thicknesses for an initial installation. Thinner liners than these can and are being used based on individual experience, but the thicknesses contained in the chart are suggested as a starting point for the mill man who is thinking about using Ni-Hard liners for the first time.

MINIMUM MILL LINER THICKNESS

MILL DIAMETER	SIZE OF GRINDING BALLS OR RODS			
	1"	2"	3"	4"
6	1.5"	2.0"	2.5"	3.0"
8	1.75	2.25	2.75	3.25
10	2.0	2.5	3.0	3.5

"Ni-Hard mill liner segments are available from authorized producers throughout the country. For the address of the one nearest you, write to Inco."

*Case histories on request

**Registered trademark

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street INCO New York 5, N.Y.

NI-HARD

NICKEL MAKES CASTINGS PERFORM BETTER LONGER

NEWS
FROM MINE AND MILL

DORR-OLIVER SETS UP BRAZILIAN SUBSIDIARY

In order to provide expanded services in Brazil, a new subsidiary corporation has been formed by Dorr-Oliver Inc. Known officially as Sociedade Tecnica, Industrial e Comercial Dorr-Oliver (Brazil) Ltda., the new company has its headquarters in Sao Paulo.

The firm will conduct sales, engineering and procurement activities relating to installations of Dorr-Oliver equipment and processes in all sections of Brazil. Local manufacturing of equipment will make use of independent Brazilian shop facilities.

Managing director of the new firm is Paul Mourier-Petersen who was previously responsible for operations in Mexico and Central America for Dorr-Oliver.

IRON ORE DEPOSITS EXPLOITED IN CHILE

Between Vallenar and Copiapo, in Chile's southern Atacama desert are rich iron ore deposits. The government is now making plans to set up a joint mining company, named Gran Mineria de Chile, to work these rich deposits.

Corfo and Empresa Nacional de Mineria, a development agency, will hold 51% of the shares, and the firms initial capital of 65 million escudos will be obtained partly from foreign credits raised by Corfo and partly from public subscription.

Ultimate annual output of the property is estimated at about five million escudos which would, after foreign debts have been paid, bring to Chile some $30 million in foreign exchange.

CLEVELAND MINE MAKES ROCK SALT SHIPMENT

The first shipment of rock salt was made recently from the International Salt Co.'s new Cleveland mine whose annual capacity is 1,500,000 tons. The first shipment, recovered as a result of mine development work, was more than 98% sodium chloride.

The mine, which has been under construction since 1958, will tap a 5100-acre area under Lake Erie. Located at Whiskey Island in the industrial area of Cleveland, the mine will ship by truck, rail and large lake vessels to a market area including Ohio, western Pennsylvania, West Virginia and the Great Lakes region.

The two vertical mine shafts, each 16 ft wide and over one-third of a mile deep, were only recently completed and development work in the salt deposit started. It took almost three years to drive the shafts from the Whiskey Island site to the salt deposit approximately 1800 ft below the surface. Development of the underground workings was started recently, but underground connection of the two shafts is still several hundred ft away.

NEW IDRIA MINING PLANS TUNGSTEN REFINERY

New Idria Mining and Chemical Co. has announced plans to build a new refinery for the production of metallic tungsten and other tungsten chemicals. The new facility will process the company's own high grade ore as well as custom concentrates from both domestic and foreign ores.

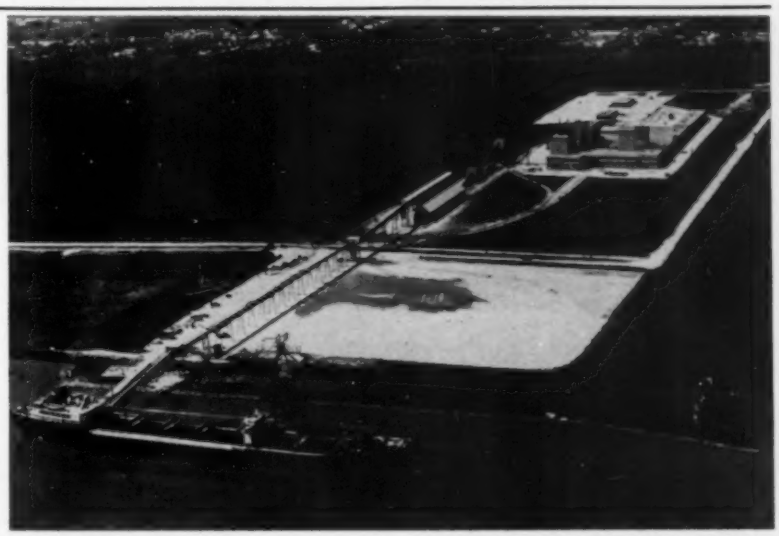
The basic process and operational procedures were developed through a research program requiring over a year for completion. Research on this project was successfully conducted by the Colorado School of Mines Research Foundation, Inc. in cooperation with New Idria and Stearns-Roger Mfg. Co.

GYPSUM PLANT OPENS ON NEW ORLEANS CHANNEL

Bestwall Gypsum Co. commenced operations at its New Orleans plant in early September. The plant, located on a 50-acre tract of land adjacent to a new multi-million dollar bulk handling facility of the Port of New Orleans, includes such facilities as: a plaster mill and packaging center, a wallboard manufacturing department, complete warehousing and shipping departments, a covered storage unit, crusher and screen mills, transfer towers, laboratory and office buildings.

The $6.6 million gypsum facility is the first to locate on the Tidewater Ship Channel, a new, shorter channel from New Orleans to the Gulf of Mexico. The new waterway is 40 miles shorter than the Mississippi River route and provides the Port of New Orleans with a more efficient route to the sea. Being built at a cost of $101 million by the U.S. Army Corps of Engineers in cooperation with the Board of Commissioners of the Port of New Orleans, the channel will extend from the Industrial Canal to deep water in Brenton Sound in the Gulf. The 76 mile long waterway servicing the new plant will have a bottom width of 600 ft and a depth of 36 ft when completed in 1967.

According to the U.S. Engineers' schedule, the channel will be usable for navigation by 1963. Gypsum ore ships supplying the new plant are presently using the navigable western end of the channel. Two hundred thousand tons of gypsum ore will be imported by the new plant annually in ship cargos averaging 14,000 to 20,000 tons.



Serviced by the New Orleans Public Belt, and Louisville and Nashville Railroads, the plant will manufacture and ship enough gypsum wallboard lath and sheathing to complete 30,000 homes annually, plus all types of gypsum wall plasters as well as graded commercial rock and agricultural gypsum. Shown above is an aerial view of Bestwall's plant site on the Tidewater ship channel.

PINNACLE EXPLORATION SEEKS UTAH IRON ORE

Pinnacle Exploration, Inc., an 80%-owned subsidiary of Callahan Mining Corp., has entered into an agreement with the Utah Mining & Construction Co. whereby Utah will explore and develop the Pinnacle-owned "Crypto" iron ore prospect near Milford, Utah. Utah Mining will initiate a drilling program in the near future and, if findings are favorable, will purchase the property from Pinnacle as was provided in the agreement.

PETROTOMICS CO. BUILDS URANIUM MILL

Petrotomics Co. has begun construction of a 500-tpd uranium mill and related facilities in the Shirley Basin area, 60 miles south of Casper, Wyo. The acid leach-solvent extraction mill is scheduled for completion in April, 1962.

Petrotomics Co., which is developing the Shirley Basin properties under a five-year Atomic Energy Commission contract, is a partnership composed of Kerr-McGee Oil Industries, Skelly Oil Co., Getty Oil Co. and Tidewater Oil Co. Stearns-Roger Mfg. Co. of Denver has been awarded the contract for engineering, procurement and construction of the mill, which is expected to cost over $2 million.

U.S. BERYLLIUM ACQUIRES CALIFORNIA MINE

One of America's earliest recognized sources of beryllium ore, the California mine on Mount Antero, Colo., has been acquired by U.S. Beryllium Corp. The California mine and California Group of claims, as they are known, were leased from G. G. Furman, of El Paso, Texas, on a 5% royalty basis.

The claims cover 52 acres of patented land and an additional 60 acres of unpatented claims located northwest of Salida, Colo., and on a triangle with Badger Flats where U.S. Beryllium already controls approximately two sq miles of claims. Ore from the California mine will be sent to the new 100-tpd concentrating plant of the Mineral Concentrates and Chemical Co. now being erected on Badger Flats, Colo.

BEATRICE POCAHONTAS SINKS THREE SHAFTS

Beatrice Pocahontas Co., a newly-formed company owned by Republic Steel Corp. and Island Creek Coal Co., has made an award to Dravo Corp. for the sinking of three shafts on the company's property in Buchanan County, Va. The sinking of the shafts is the first step in the development of a new mine being designed to produce 1,200,000 tons annually of Pocahontas #3 seam coal.

Work on the three shafts, each of which will be approximately 1400 ft deep, was to have commenced in September and will require an estimated 15 months to complete. Some 85 men will be employed locally on this phase of development.

FLINTKOTE DEVELOPS NEWFOUNDLAND QUARRIES

The McNamara Construction Co. of Newfoundland, Ltd. has been awarded a contract by The Flintkote Co. to develop facilities at its Flat Bay quarries in Newfoundland. The $1½ to $2 million contract provides for completion of a six-mile long aerial conveyor from the existing quarries at Flat Bay to Turf Point and construction of pier facilities at Turf Point. A crushing building and related conveyor system also will be built at the quarries. Work will begin at once and should be completed in about one year.

AEC CONTRACTS EXPAND URANIUM MARKET

The Atomic Energy Commission has exercised its option to extend the term of the contract with Kerr-McGee Oil Industries, Inc., covering production from the Shiprock, N.M. processing mill, from June 30, 1965 to December 31, 1966, with no increase in the over-all commitment for the purchase of U_3O_8 in the form of concentrate.

With this action there are now five uranium mills having contracts with the AEC extending through 1966 which provide for the purchase of eligible ore from independent producers of uranium-vanadium ores. The uranium concentrate purchase contracts between the AEC and the milling companies provide that each independent ore producer must enter into an ore purchase contract with the mill operator, which contract must be approved by the AEC before the mill operator can purchase ore. This provision is being waived temporarily to allow for continued delivery of ore pending completion of these ore purchase agreements.

INCO (CANADA) TO BUILD PELLETIZING FACILITY

International Nickel Co. of Canada, Ltd. has awarded Dravo Construction, Ltd., Toronto, Ontario a multi-million dollar contract to design and construct a new pelletizing facility at its Copper Cliff, Ontario plant.

The project, which will include revisions to an existing pelletizing plant for which Dravo furnished the pelletizing grate and process equipment in 1954, is part of a $50 million expansion program recently undertaken by Inco at the plant located four miles outside Sudbury, Ontario, about 200 miles northwest of Toronto.

The new facility, like the existing one, will employ the Dravo-Lurgi traveling grate pelletizing process to produce pellets of approximate ¾ in size. In this process, equipment requirements are simple, with all firing and cooling carried out on one piece of machinery. (See MINING ENGINEERING, July 1961, page 658.)

When completed early in 1963, the new addition will have an annual rated capacity of about a half million tons of high grade iron ore pellets. Total rated capacity of the entire pelletizing facility will be 900,000 short tons of high grade, 68% iron content iron ore pellets, produced from 1,200,000 short tons of nickeliferous pyrrhotite, a high iron content material which otherwise would have to be handled by the nickel section of the company's Copper Cliff smelter.

U. S. BORAX & HOMESTAKE IN JOINT POTASH SEARCH

United States Borax & Chemical Corp. and Homestake Mining Co. have entered into a joint venture to complete studies relating to possible large scale potash production in Saskatchewan, Canada, where U.S. Borax has been investigating permits held since 1957.

If the completed studies should indicate the technical and economic feasibility of a Canadian potash operation, the two companies may participate equally in any company formed for such purpose. One or more additional associates may also be invited to participate in future ventures.

U. S. BORAX AND VITRO IN RARE EARTH CONTRACT

In another venture, United States Borax & Chemical Corp. has signed a rare earths agreement with Vitro Chemical Co. under which the former will exclusively distribute Vitro rare earth products to the glass and ceramic industries in the U.S., Canada and Mexico.

Vitro will continue to market these products in industries not normally served by U.S. Borax. These include such areas as electronics, metals and alloys, nuclear, ophthalmic, mirror and precision optical.

NATIONAL GYPSUM EXPANDS FACILITIES

Expansion projects at its Portsmouth, N.H.; Newburgh, N.Y.; and Garwood, N.J. plants have been announced by National Gypsum Co. New docks will be constructed at the Portsmouth plant which makes gypsum wallboard, lath, plaster and other building materials. It is supplied with gypsum from the company's Nova Scotia mining development by National's fleet of ore carriers. The Newburgh and Garwood plants manufacture paper liner for gypsum building products. Chairman Melvin H. Baker said the papermaking capacity of both plants is being "substantially expanded."

(Continued on page 1128)

only one moving part makes dependable percussion drilling power

The piston is the only moving part, which means less wear and less trouble. No complicated valving to sand up as in many bottom hole pneumatic impact tools. You can easily change the choke which adjusts the Hammerdril to the air volume needed from your 100 psi compressor. The Series 100 Hammerdril® is an air miser, too. All the air goes through the Hammerbit® to clean or to drill. None is wasted. This splined, one piece Hammerbit has heavy tungsten-carbide inserts for long life. Service is available in your area. Write for new bulletin.

MISSION MANUFACTURING CO.

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P. O. BOX 4209 · HOUSTON, TEXAS / OVER THIRTY YEARS OF DRILLING RESEARCH

NEWS
FROM MINE AND MILL

(Continued from page 1126)

$10 MILLION POTASH EXPANSION

International Minerals & Chemical Corp. has announced plans for a $10 million expansion of production facilities at the potash mine project of its Canadian subsidiary. The expansion, which would increase output potential from 420,000 tons to 1,200,000 tons of potash product annually, is being planned to meet expected sales demand. The expenditures will bring total plant investment close to $40 million upon completion.

Initial production from the shaft at Esterhazy, Saskatchewan, is scheduled for the summer of 1962, and refining facilities already completed will handle 420,000 tons of product annually. Engineering and design on the additional facilities will get under way immediately, and capacity operation is expected to begin in January of 1963.

KAISER STEEL SELLS ORE TO JAPANESE FIRM

Kaiser Steel Corp. has signed a ten-year contract for the sale of a total 10 million long tons of iron ore to the Mitsubishi Shoji Kaisha Ltd. of Japan. The iron ore will be produced at Kaiser Steel's Eagle Mountain mine in Riverside County in Southern California, and shipments will begin the latter part of next year at the rate of one million long tons per year.

The first portion of the haul will be over Kaiser's 50-mile long railroad. Then Southern Pacific Railroad will carry the ore from Ferrum, near the Salton Sea, to Long Beach, where the port is building new facilities to handle stockpiling and loading. The ore will be shipped to Japan in 50,000-ton ore vessels which will be constructed for Mitsubishi in Japan.

WATER JETS TRIED IN COAL MINING

A large-scale research project to determine the feasability of mining coal with powerful jets of water will be undertaken in Washington State as a joint venture of the U.S. Bureau of Mines and the Northern Pacific Railway Co. The announcement followed the signing of an agreement between the Bureau and the railroad for conducting the experiments in the company's mine at Roslyn, Wash., about 70 miles east of Seattle.

Hydraulic mining is sought as the answer to difficult problems in producing coal from steeply pitching beds encountered in the Roslyn mine and other mines in Washington. The Bureau of Mines has studied hydraulic mining of bituminous coal in central Pennsylvania. However, the Pennsylvania mine, having a nearly horizontal coalbed, differs considerably from the operation contemplated in Washington.

In the Washington experiments, a pump capable of supplying water at pressures up to 4500 psi will be installed. The nozzle output will be about 40 gpm. The Pennsylvania tests showed that eastern bituminous coals broke readily at even lower pressures, but with greater volumes of water.

KENNECOTT CONSTRUCTS METAL RESEARCH CENTER

A site in the Lexington Park section of Lexington, Mass., has been purchased by Kennecott Copper Corp. as a location for its new Basic Research Laboratory, construction of which is expected to be completed in about one year.

The company's research program will emphasize solid state physics of metals. The new research venture is aimed at obtaining fundamental knowledge and the discovery of new scientific facts pertaining to the metals industry.

According to Dr. Ewan W. Fletcher, director of the research laboratory, the long range objectives of the Basic Research Laboratory are "to create a comprehensive rapport with the scientific community to cooperate in areas of basic interest of the Laboratory so that Kennecott and its subsidiaries can utilize scientific discoveries from all over the world; provide consultants to Kennecott from the staff of the Basic Research Laboratory . . . ; contribute to the basic knowledge and produce discoveries of a fundamental nature which will result ultimately in new materials and products; search for the basic relations between electronic, atomic and molecular structure to those of the macroscopic world in the form of the physical, mechanical, electrical, magnetic and thermal properties of materials; and cooperate with all academic, governmental and industrial fundamental groups on an international scale to contribute to the generation of an interdisciplinary materials science which will undoubtedly evolve in the present decade."

CHEMICAL FIRE HAZARDS STUDIED

An extensive research program into the fire hazards of ammonium nitrate and related materials will be undertaken by the U.S. Bureau of Mines under a cooperative agreement with the Manufacturing Chemists' Association, Inc.

The research project is expected to begin soon and will run for one year, with the entire cost of $60,000 borne by the Association. The agreement provides for an extension beyond the one year period if necessary.

According to the cooperative agreement, the research will cover not only the fire hazards of ammonium nitrate, but of such related systems as nitric acid-hydrocarbon, ammonium nitrate-urea and combinations of these systems. The Bureau will study the effect of contaminants, and of confinement on the detonability of solid and molten ammonium nitrate, and evaluate its sensitivity to initiation by the close proximity detonation of other explosive systems.

PHELPS DODGE RESUMES FULL PRODUCTION

Responding to increasing demand for copper, Phelps Dodge Corp. has temporarily resumed full scale copper production at its Arizona mining properties.

The company had reduced its Arizona production by 10% in two stages in 1960 as a result of a decline in demand. The full production schedule is expected to bring the company's monthly copper output to 2600 tons.

COLUMBIUM MINE PREPARED TO OPEN

St. Lawrence Columbium and Metals Corp. is scheduled to begin regular open pit production at its 500-tpd mill at Oka, about 30 miles west of Montreal. Tune-up operations have begun and the company expects an annual output of 2,800,000 lbs of concentrate grading between 50 and 55% columbium pentoxide.

The company has a contract with Samincorp of New York under which it will sell a minimum of 500,000 lbs of concentrates over a 15 month period beginning October 1, 1961.

CONSOLIDATED COAL BUYS LILYBROOK COAL CO.

Consolidated Coal Co. has purchased Lilybrook Coal Co., Grundy, Va., which operates the Lilybrook and Killarney mines in the Beckley, W. Va., area.

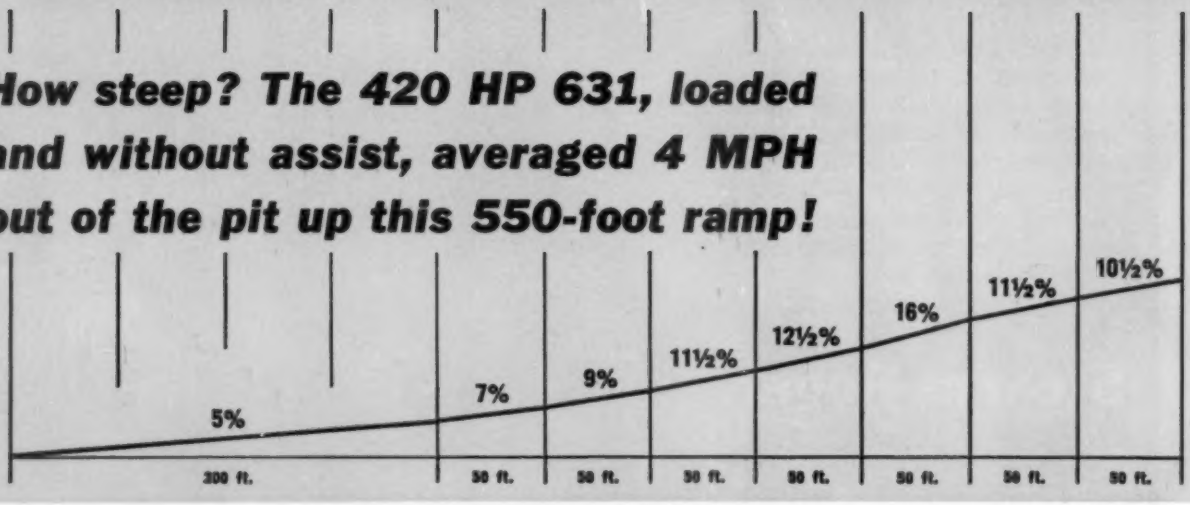
Consolidated has also purchased the plant and equipment and leased the coal at Arista mine, formerly a Walter Bledsoe & Co. property, and the Berwind No. 1 mine, formerly property of New River & Pocahontas Consolidated Coal Co. The purchases became effective September 1.

INTERNATIONAL HARVESTER IMPORTS DIESELS

International Harvester Co.'s Construction Equipment Division has begun imports of small, German-built diesel engines in five power sizes. The units are products of the company's subsidiary firm in Neuss, West Germany, where diesel engine manufacture has been carried on since 1949. These engines do not replace any existing U.S.-built engines. The diesels are designed for sale to the company's distributors and original equipment manufacturers.

NEW POWER SHIFT TAKE STEEP GRADES

How steep? The 420 HP 631, loaded and without assist, averaged 4 MPH out of the pit up this 550-foot ramp!



The job: Stripping overburden for bauxite in Bauxite, Arkansas, for Dixie Contractors Inc., Memphis, Tenn.
Length of haul: 5400 feet one way, with the first 550 feet adverse grade.

CAT WHEEL TRACTORS IN STRIDE

This was no one-shot demonstration under favorable conditions. This was one of the many tough jobs where Caterpillar's Research Department placed 631s to field-test the production capabilities of these units. The results of this study particularly emphasize the value of Cat power shift on steep grades. But power shift pays off in other ways, too.

Matter of fact, it begins right in the cut. When the operator starts in load range, the scraper stays right with the pusher—doesn't pull away every time he raises the bowl to pump in a few more yards. When the scraper's packed full, he slips the shift lever into 1st range and steps on the accelerator. No spinning or bucking—it picks up the load right away. Depending on the grade, it shifts *automatically* up to direct drive . . . and then *automatically* to overdrive . . . or *automatically* down again as the steepness dictates. Topping the grade, the 631 quickly accelerates to hauling speeds, over 30 MPH.

That's because, unlike ordinary power shifts, the Caterpillar unit matches power *automatically* to job conditions. It gives you *three* types of drive—torque divider drive (25% of engine torque multiplied by the converter and 75% bypassing it), direct drive and overdrive—in each of three speed ranges.

In all, it provides nine different speed variations, but the operator need concern himself only with the three speed ranges and load range controlled by one lever.

Cat power shift—rugged yet simple

How rugged is the new Cat power shift transmission? Consider this. Although the concept for scrapers is new, much of the basic design is not. It's similar to the proven D8 and D9 power shift transmissions, which—over the past two years—have racked up thousands of hours of trouble-free operation. The main difference is in the arrangement of the exclusive torque divider, where a direct drive and overdrive arrangement have been added. Automatic shifting through these three types of drive is accomplished by a simple mechanical speed-sensing device and a hydraulic valve which actuates clutches. A shift indicator shows when to change speed range up or down as needed.

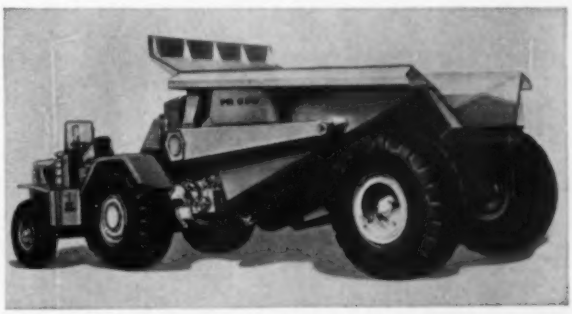
Full unit construction—easy servicing

Cat wheel Tractors give a smooth, stable ride . . . and they're easy to service. They feature full unit construction. Every major component can be serviced without disturbing adjacent units. Two examples: (1) The torque divider transmission is removable without disturbing the engine. (2) The fan is mounted on the radiator shroud for removal as a unit.

Two power shift 420 HP models—the 631 and 630

Which is best for your job—the two-axle 631 or the three-axle 630? Both are powered by turbocharged, aftercooled 420 HP engines. The 631, carrying 28 cu. yd. heaped, has a high usable speed of 31 MPH. The 630 has a usable speed of 41 MPH and is available with two scrapers—capacities, 28 yd. and 35 yd. heaped. For complete information about the new 631 and 630, see your Caterpillar Dealer. Ask him to prove how they can step up your production and lower your costs!

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.



NEW ATHEY WAGONS . . . the 38-ton PR630 and PR631 Rock Wagons and 60-ton PH630 Coal Hauler are built by Athey Products Corporation for matched use with Cat wheel Tractors.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

PRODUCE MORE AT LOWER COST WITH POWER SHIFT CAT WHEEL TRACTORS

For further information, circle the following numbers on the reader service card: 30, Wheel Tractor 630; 31, Wheel Tractor 631; 32, Athey Rock Wagon PR630; 33, Athey Rock Wagon PR631; 34, Athey Coal Hauler PR630.

First local supply center for Spencer pre-mixed ammonium nitrate blasting agent (NCN-1) is located at Carlsbad, New Mexico. Similar plants are proposed for other sections to fill local needs for low cost pre-mixed compounds of guaranteed uniform quality. Spencer NCN-1 Nitro-carbo-nitrate will be available in handy 50-pound bags.

Spencer announces NCN-1*

. . . another new service to lower blasting costs

More blasting efficiency for every dollar you spend! That's the promise of Spencer's far-ranging research program. This continuing program of investigation explores every new and better method of making blasting more efficient, safer, and less expensive.

Newest development in Spencer's program of maximum service to mining and construction users of blasting materials is an NCN-1 (Nitro-carbo-nitrate: pre-mixed ammonium nitrate blasting agent) plant in Carlsbad, New Mexico.

Designed to deliver NCN-1 by truck in handy 50-pound bags to the site where they are to be used, this new plant is the first of a network of producing depots that will provide local sources of supply to users in every part of the country.

Pre-mixing of the ammonium nitrate blasting agents provides a cleaner, easier to handle compound with more uniform blast output. Initially, the Carlsbad plant output has been established to meet current daily demands, but capacity expansion is planned to meet anticipated future increases in local usage.

And, of course, Spencer's NCN-1 is substantially less expensive than dynamite. But that's not all. Spencer's NCN-1 will provide 10% to 20% more blast energy than field compounded ammonium nitrate-fuel oil mixtures. That's accomplished through easier detonation resulting from the optimum density of the Spencer mixture and the special prill structure of Spencer's N-IV* ammonium nitrate which enables it to absorb fuel oil more evenly.

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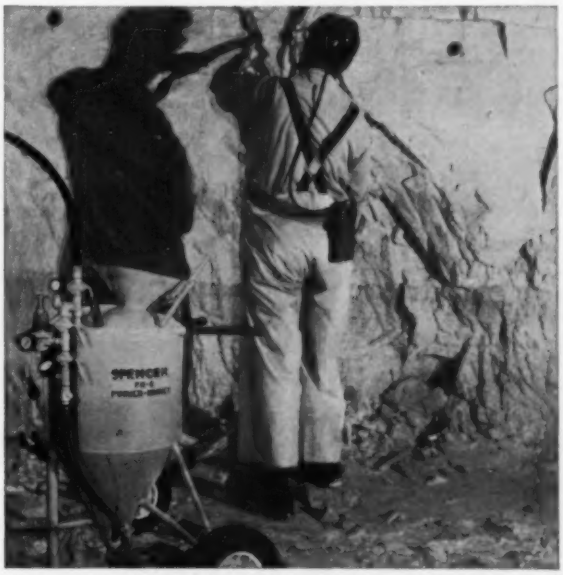

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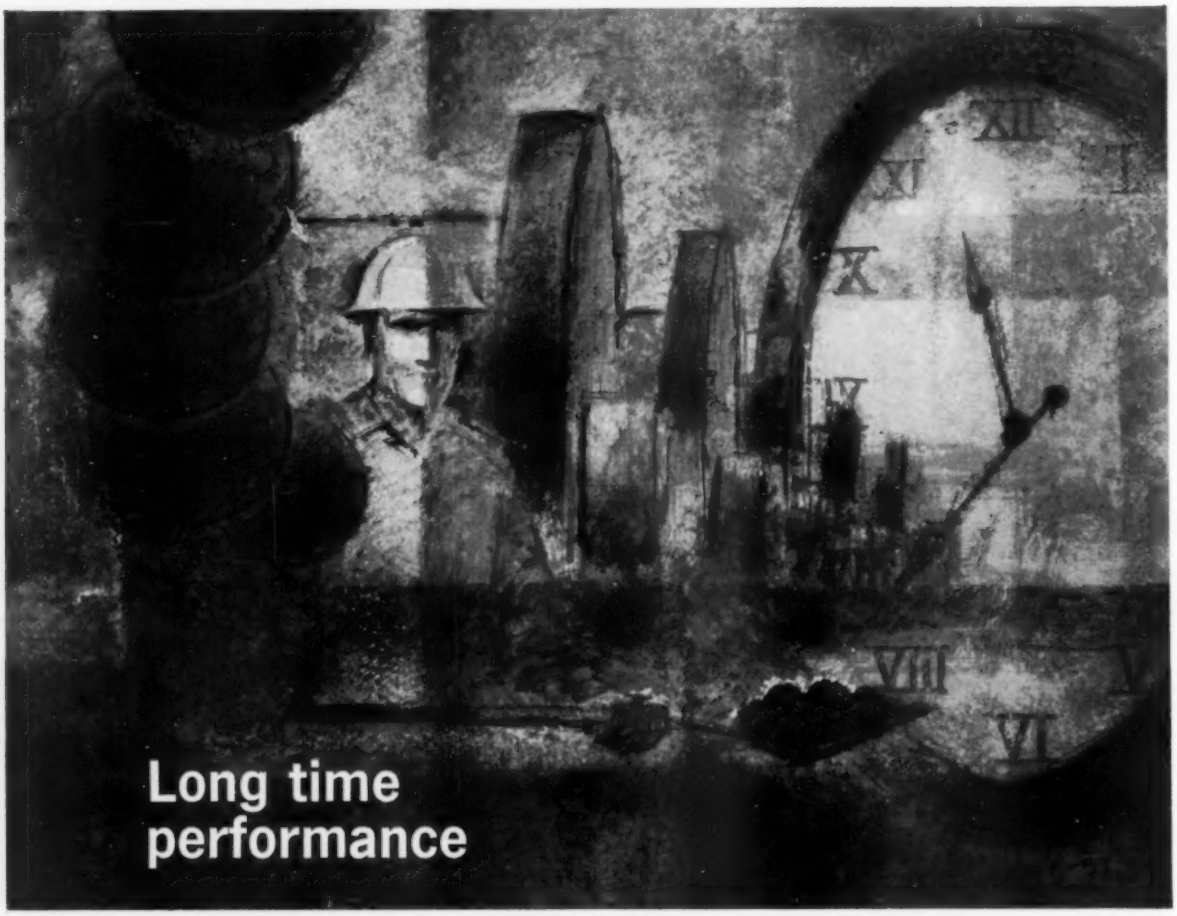

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THE DRIFT OF THINGS

as followed by J. V. Beall

In an old Iroquois dialect, "Adirondack" means "bark eater." That was the derisive name the Iroquois used for their enemies, the Abenaki or St. Francis Indians. The latter tribe used to hunt in the Adirondack Mountains of upper New York State during the summer, but according to Eugene O'Connor, who recently became the first 20-year man at the MacIntyre Division of National Lead, they didn't live there because the weather was too inhospitable most of the year.

On a summer day, the cool green forests and sparkling lakes cause today's traveler to slow down and linger in the delightful unspoiled mountain country. The first prospectors probably came in the summer, but the mineral attractions were sufficient to build up a substantial year-round mining industry. Some mining and smelting of iron ore took place near Tahawus prior to the Civil War, and it wasn't much later that the Barton family started mining garnet at Gore Mountain. From these unpretentious beginnings a substantial, diversified mineral industry has grown. Not much fanfare has accompanied the monumental engineering accomplishments made up there: Republic Steel was mining and processing a 25% magnetite ore to a plus 64% Fe sinter in this area, decades before the higher grade taconites got rolling; in the forties, another milestone was added by National Lead in the unlocking of ilmenite from a magnetite ore at Tahawus; in the fifties, still another beneficiation landmark when Jones & Laughlin began marketing a product made from nonmagnetic martite of Star Lake.

A visit to the Adirondacks, as we recently learned, is a rewarding experience even if one discounts the obvious outdoor recreational attributes. However, it looks extremely peculiar if you don't have a canoe on the roof of the car or an outboard motor on the back seat. There are fine people up there and they are doing a lot of interesting things. The most is made of SME membership also, because of the active Adirondack Section which holds monthly meetings in the summer with field trips and two other meetings during the year. The Annual Social gathering always attracts a large group with their wives.

It is noteworthy that, although the Abenaki Indians were as transistory as summer tourists, the present inhabitants are a far hardier breed as evidenced by the long service records of employees at the various mining operations. At Gore Mountain there is a shovel operator with 48 years to his credit with Barton Mines. Joe Tolosky, mine superintendent at Lyon Mountain has 42 years service. These are outstanding examples, but the mines generally can boast of remarkable stability in employee service records at all levels.

Rockdrill sales engineers will find the Adirondack area very interesting but also highly competitive. Because of hard abrasive conditions encountered in the metamorphic and intrusive rocks of the district, a great deal of attention is paid to drilling costs. Different solutions have been found at the various properties: In open-pit work, both down-the-hole and surface rotary-percussion drills are used. In some cases, holes are inclined for better distribution of explosive force and burden, whereas in others vertical holes are preferred. A-N blasting with dynamite bottom-hole charge in various combinations is being used and a new slurry explosive was being tried. Underground use of the Swedish integral steel and chisel bit is spreading.

On the milling side, two things, if not new, are fairly recent and gaining wider acceptance. One is the Dutch State Mines screen which is noted for its low maintenance requirements. The other is the varied use of Linatex. This material is used as a reliner for getting added months of life from pumps. This "do-it-yourself" type of repair is applied to various jobs including lining Humphrey spirals and covering conveyor-belt idlers.

At Tahawus, which means cloud splitter in the Seneca language, Brower Dellinger, assistant manager, and Stan Gross, chief geologist, showed us around the National Lead Co. property. National Lead's interest in mining ilmenite for its TiO_2 content began in 1941. Today the company mines about 8000 tpd of ore and up to 12,000 tpd of waste. Both ilmenite and magnetite concentrates are recovered. A major south extension of the orebody which underlies a tailing area and part of the townsite was recently discovered.

Stan Gross introduced us to Stanley Lalonde, the mine surveyor and a crack photographer. Some nights earlier he had surprised a 300-lb bear which he photographed nose down in his garbage can. Besides shooting refuse containers and taking useful photographs of the operations, the company uses Stanley's talents for photographing machinery parts that fail in operation and damaged shipments for insurance claims. They find that a photograph saves a lot of difficult written explanations.

Bill Blomstrom, district manager for Republic Steel, is in charge of the oldest continuous mining operations in the area, dating back to the early 1800's. He mines magnetite at Lyon Mountain, near Plattsburgh, and Mineville at the south end of Lake Champlain. Mineville is currently shut down for market reasons. We were fortunate to visit Lyon Mountain when Bill was there and he introduced us to Ed Knox, general superintendent, who is currently planning a deepening of the west shaft. Joe Tolosky and Bernard Hart, industrial relations, escorted us through the mine, which is a sublevel, longhole stoping operation producing about 4000 tpd. Later at the concentrator with Judd Tolosky, mill superintendent, we got a good look at the way they reline pumps with Linatex. The effectiveness of these reline jobs is attributed to the skill of Marvin Caron in cutting joints, fitting and laminating. Rubber sheets are bought in 1/16, 1/4, and 1/8-in. thicknesses and the necessary lining thickness is built up. Marvin spent two months in Liberia lining pumps at Republic's operation.

At J & L's Star Lake iron ore property we made the acquaintance of Grant Fleck and Art Peterson. This is the biggest operation in the Adirondack area and is normally rated at about 1½ million tons annually of combined sinter and concentrates. Both magnetite and martite ore are open-pit mined and a portion of the latter is autogenously ground in an Aerofall mill. Of particular interest is the sinter cooling tower which went into operation last November. The tower, developed by the Benson staff and the Dravo Corp., air cools the sinter, a process better for the product than the standard water cooling method.

Any visitor should also see the belt conveyor setup which transports crushed ore to the concentrator and sinter plant. There are two belts traveling a gallery designed for but one. One belt is mounted between the load side and return of the other. Transfer points for the inner belt are achieved by putting big loops in the return of the outside belt. The system was developed to eliminate the necessity of building a new gallery and trestle when the martite circuit was added.

At Balmat near Gouverneur, there are two talc mining and processing operations, International Talc and Gouverneur Talc, and zinc mining and concentrating by the St. Joseph Lead Co. St. Joe's operations include a 400-tpd mine and concentrator at Edwards and a 1800-tpd operation at Balmat. We visited the latter operations with Mark Riley, assistant manager, and Clarence Caswell, mine superintendent. Balmat's zinc ores occur in a multiple vein system in a hard, metamorphosed limestone. The ore is mined by open stopes and longhole drilling.

Malcolm Lowry, superintendent of mills, is benefiting from some new equipment acquisitions which have economized on space and added flexibility to his zinc flotation circuit. The Fagergren cells replacing St. Joe cells are set up in two separate parallel circuits, each with its own reagent feeders. Testwork can now be carried out on mill scale.

Gouverneur Talc is mining in close proximity to St. Joe. In fact, underground surveys have to be coordinated between the two companies. Each has separate mineral rights on the same ground, one for zinc ores and the other for talc. The chief talc mineral is tremolite, a calcium-magnesium silicate. As Bob Smith, mill superintendent, and George Erdman, mining engineer, explained, their product is used chiefly in paint and ceramics as a filler or extender. Quality control for color, softness, specific resistivity, and magnesium content are critical. Five different classes of ore can be identified underground and are mined according to plant requirements. The plant produces about thirteen products. At this operation, rock in the box at millhead isn't enough. Each 90-ton bin load is held until analyzed before being put through the plant.

Barton Mines Corp., at Gore Mountain, mines garnet and manufacturers 200 products on the spot for the industrial abrasive markets of the Free World. This relatively small open pit operation supplies 90% of this market. Two great grandsons of the founder, Hudson Barton, president, and Charles Barton, assistant to the president, reside in the area and actively manage the destiny of the company. We were fortunate to meet these two gentlemen who presented Herman Vogel, presently a consultant, but whom they credit with many of the original manufacturing techniques developed during his years as an engineer for the company. We learned that Barton products range in size from 20 mesh to ¼ micron and can be identified in some industrial applications as a Barton product by black specks of hornblende which are a natural trademark. The garnet occurs in a metamorphic rock of unknown origin. Each garnet "pocket" has a halo of hornblende. Charles told us that a sample of this hornblende was subjected to the artificial diamond process and was converted to garnet.

On Route 28 at the turnoff for Barton Mines, there is a rustic sign which advises that visitors may be guided to the mine and visit a mineral museum and gift shop. This is a distinctive and generous sideline of the Bartons. The shop and tours are run by college students who have the concession at no cost from the company. The modest fees charged visitors are the student's profits which help them with their educational expenses.

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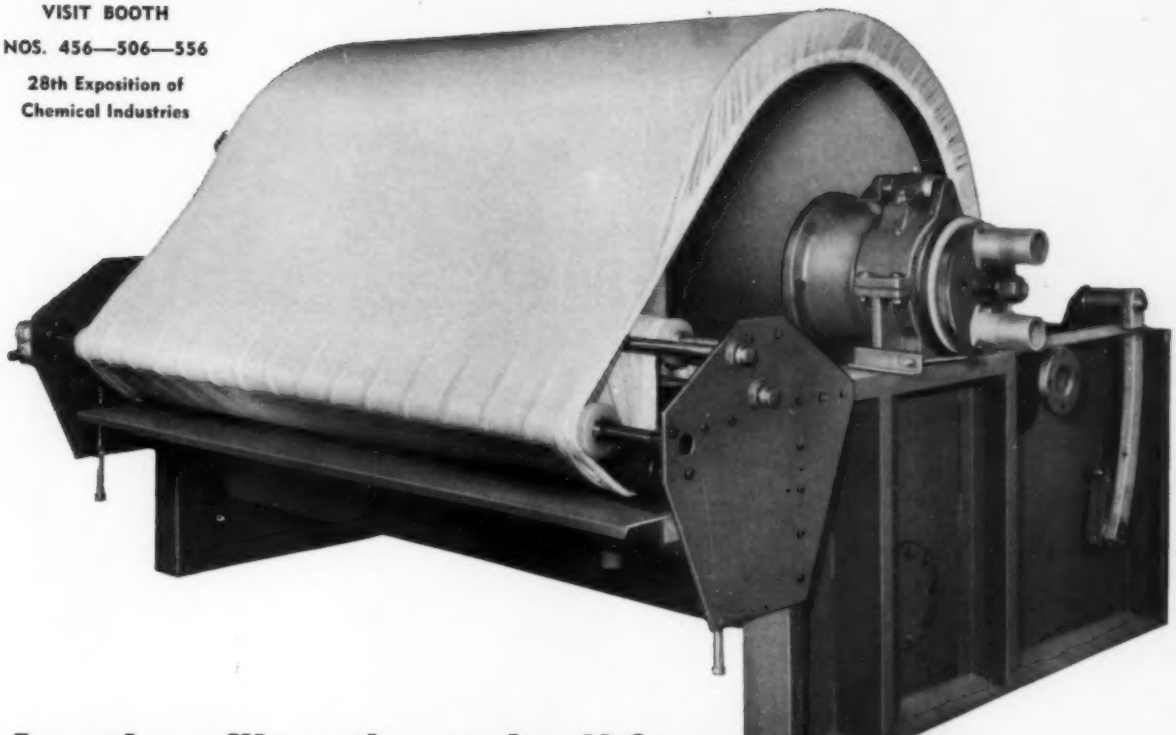

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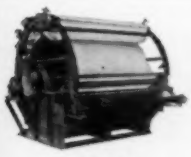

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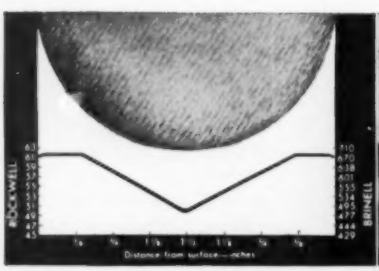

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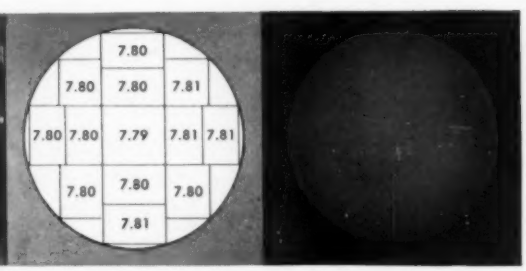

UNIFORM SOLIDITY. Grid, at left of X-ray photograph of Naco Ball, shows average specific gravity of various sections. Figures are from 169 three-quarter inch sections from 13 production balls.

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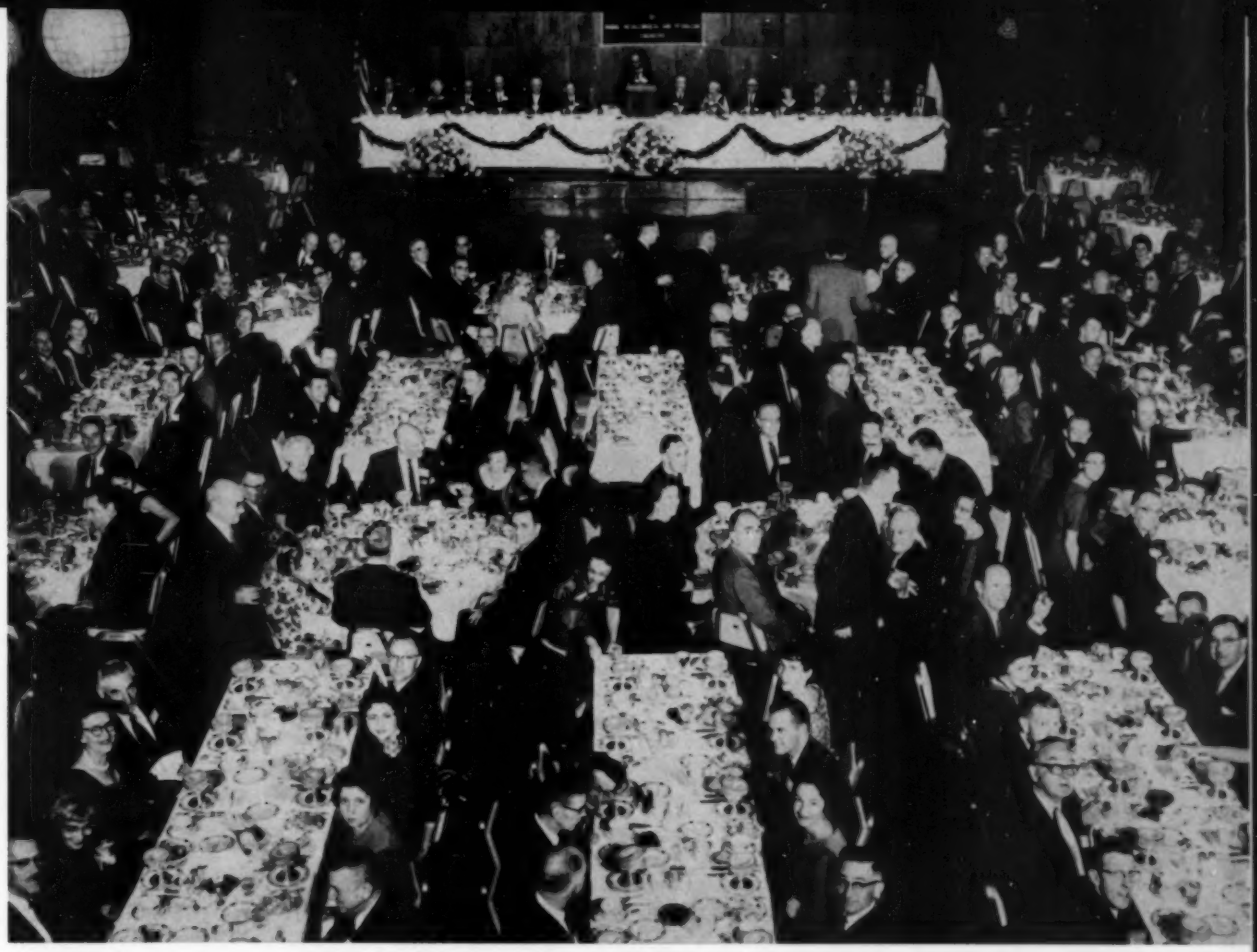


THE 50th ANNIVERSARY OF FROTH FLOTATION IN THE U. S.

Flotation Men Study Current Practices, New Frontiers at Denver Meeting

Scientific elite of the Minerals Beneficiation Div. assembled in Denver, Colo., September 17 to 20 to commemorate the 50th Anniversary of Froth Flotation in the United States of America. In his warm address of welcome at the opening luncheon, John W. Vanderwilt, President, Colorado School of Mines, recalled his experience in Bonanza which coincided with the early days of flotation. In those years the scientific and engineering aspects of the process which we know today were little understood and operating the flotation circuit was considered an "art." Luncheon Chairman H. L. McNeill caught the flavor of the old days in an anecdote which recalled the mill nightmares to many present with the agonized words, "Oh God, what's happened to the concentrate now!" It was an appropriate gesture when he called the names of some of the flotation greats for presentation to the assembly; and many an "artist" there was among them!

Catapulting the audience at the first technical session from the early years to the scientific present, renowned A. M. Gaudin, Professor, MIT, pondered, ". . . fifty years later than the beginning, but still there are beginnings." His "beginning" transported the audience from the world of minerals which they know so well to the domain of microbiology. In the field of mineral flotation, particles range from millimeters to microns, whereas microorganisms range in size from 20,000 mesh, ¾ of a micron, on down. Although sizes and shapes of mineral particles treated by flotation are a wide spectrum, in individual flotation problems of microorganisms the researcher contemplates only one or two sizes and shapes. However, microorganisms, being living matter, reproduce. From one look in the microscope to the next, the family has multiplied—an unusual problem from the balance-of-materials standpoint. Successful flotation of microorganisms has opened broad vistas of practical application. In a discussion following the presentation, Prof. Gaudin mentioned some of these applications. In the field of medical diagnosis, a specimen taken from a patient might someday be examined by selective flotation. Extracting microorganisms from water or sewage which presents the problem of bulk removal from an even greater bulk of liquid is an area of possible practical application. Other prospects are separating organisms for the pharmaceutical industry and extracting the larger organisms which exist in sea water, such as plankton. Dr. Gaudin's paper was not printed prior to the meeting since it will appear in the 50th Anniversary Flotation Volume to be published early next year by SME.

The three days of technical sessions were attended by 500 specialists in flotation. Each registrant received the *Quarterly* of the Colorado School of Mines (Vol. 56, No. 3, in two volumes, July 1961) which contained the papers presented at the tech-

Speaker's table guests for the banquet are (seated from left): F. R. Milliken, speaker of the evening; Mrs. F. E. Briber, Sr.; Mrs. R. R. McNaughton; Mrs. A. G. Hoyl; Mrs. Norman Weiss; Prof. A. M. Gaudin, 50th Anniversary Exec. Comm. Standing from left: R. D. Moody, Luncheons Chairman; Neil Plummer, MBD Chairman; W. B. Stephenson, SME President-Elect; F. E. Briber, Sr., Meeting General Chairman; R. R. McNaughton, AIME President; J. C. Fox, SME Secretary; A. G. Hoyl, Colorado Section Chairman; E. D. Dickerman, Banquet Chairman; Norman Weiss, 50th Anniversary Exec. Comm.; J. D. Vincent, 50th Anniversary Chairman; Nathaniel Arbiter, 50th Anniversary Exec. Comm.; H. Rush Spedden, MBD Past-Chairman. Some 500 flotation men attended the sessions.

nical sessions. Armed with the published papers, audience participation in discussion was brisk and much additional useful information was disclosed thereby. (A complete program of the technical papers is given in the August issue of MINING ENGINEERING, and the volumes containing the papers may be purchased for $5 from the *Quarterly* of the Colorado School of Mines, Golden, Colo.)

The tremendous success of the meeting can be attributed to skillful handling by General Chairman Frank E. Briber, Sr., and his committeemen, and to Mrs. Fred Smith for the excellent ladies program for which about 100 ladies registered. At the Scotch Breakfast on Wednesday morning, E. H. Rose, Millman of Distinction, presented an illuminated scroll to Frank Briber in appreciation for his work on the meeting. In addition there was strong support of the meeting by the companies, too numerous to list here.

At the banquet on Tuesday night, R. R. McNaughton, AIME President, congratulated the Minerals Beneficiation Div. and the committees on the

Grouped at the Monday cocktail party are: Mrs. McNaughton, President McNaughton, Norman Weiss, Mrs. Weiss, Mrs. Briber and Mr. Briber. The cocktail party was sponsored by manufacturers and mining companies.

Visiting during the cocktail party are Frank D. Thayer, Kennecott Copper Corp., Hurley, N.M.; A. H. Ross, American Metal Climax, Inc., N.Y.; Mrs. LeBlanc; and Prof. Raymond LeBlanc, Ecole Polytechnique, Montreal.

At left, the camera captures Harold Neustaeder, St. Louis, in a relatively private chat with G. A. Frame, Inco, Copper Cliff, Ontario. Speakers at the opening technical session are: Phil F. Allen and Norman Weiss, Co-Chairmen; Prof. D. W. McGlashan, Montana School of Mines; Roshan Bhappu, New Mexico Bureau of Mines; and, seated, Luigi Usoni, representing Consiglio Nazionale Delle Richerche, Rome, Italy; and Prof. A. M. Gaudin, MIT.

outstanding job which they had done. Referring to the Bible text of walking a second mile, he cited this as the characteristic mark of the true professional. He called membership in the AIME "an opportunity for professional growth not possible in any other way."

H. Rush Spedden, presiding at the banquet, presented the dignitaries at the head table and then introduced Frank R. Milliken, president, Kennecott Copper Corp., who delivered the address of the evening: "Flotation—The Main Spring of the Minerals Industry." Mr. Milliken, Richards Award winner for his contributions to minerals beneficiation, said, "We are here to salute a great process . . . but also man's amazing capacity for achievement." Before the discovery of smelting metal ores, which occurred some 5000 years ago, man was limited to copper and gold which were found as native metals. The development of flotation, he said, ranks with smelting in the encyclopedia of man's achievements. No other single discovery made so much metal available. He recounted the metals now recovered, the nonmetallics to which the process has been extended and the low grade ores and reworking of old tailing dumps made economic by flotation. In connection with the emergence of flotation practice in the chemical, paper and food processing industries, he estimated that the gross value of all flotation products at 1-½ billion dollars annually.

Mr. Milliken said that many people were involved in the invention of flotation but that Mineral Separation had the original U.S. patents. The present commemoration ceremonies are dated from the opening of the first plant by Butte Superior, Basin, Mont., in 1911. He called Lister's Broken Hill invention of selective flotation of one sulfide from another as the next most important forward step. Mr. Milliken looks for another technical breakthrough similar in importance to flotation which the base metal mining industry badly needs. Mineral dressing has advanced more in the last 50 years than in the previous 5000. In closing, he said that it probably would not be even so long as 50 years before the next development is achieved.

A meeting of such importance and impact as the 50th Anniversary of Froth Flotation was not easily achieved. MBD planning began in 1956. J. D. Vincent, Chairman, Executive Committee for the 50th Anniversary and his many committeemen can take pride in their achievement. The long list of giants in this field who came from all over the world to participate is reward enough for their efforts. The value will long be remembered, and ideas germinated in Denver will be future milestones in the march of progress.

Although the meeting has ended, another rich reward is in store. D. W. Fuerstenau is putting the final editorial touches on the chapters of the 50th Anniversary Volume written by many prominent authors. This work will be published in early 1962.

Session Co-chairmen E. H. Rose, left, and W. B. Stephenson, right, go over schedule with Prof. Melvin A. Cook.

AMC SEATTLE MEETING

REVEALS MINING INDUSTRY

SCRAPPY, READY FOR COMPETITION

Three men from Congress and a miner made for a rousing session on labor, politics and foreign competition. Left to right: P. J. Hillings, former congressman now with Ford; former Representative from North Carolina Graham Barden; John H. Dent, Representative from Pennsylvania and Meeting Program Chairman J. C. Kieffer of Asarco, who also served as session chairman.

Seattle offered sunny, dry weather to about 2500 mining men who assembled September 10 to 14 for the 1961 American Mining Congress. The impact of snappy sessions on national mineral policy, state of the industry and foreign competition (to name only a few) was somewhat overshadowed by enthusiasm of conventioners for salmon fishing. This lordly fish, which mysteriously runs to its hatching place to spawn and die at this time of year, was not cooperating with the anglers in Puget Sound. However, this did not prevent consuming ample amounts of the deliciously prepared Quinault salmon at the "Potlatch" celebration.

About 110 years ago, Doc Maynard canoed by the present site of Seattle, which was then an attractive looking beach, on his way to examine some alleged coal deposits. He didn't find any coal, but later he remembered the beach when a friend inquired about a good trade location. Thus the early beginning of Seattle was influenced by coal, said J. F. Core, Chairman, AMC Coal Div., at the welcoming luncheon.

Hon. Albert D. Rosellini said that mineral production has steadily increased in Washington over the last ten years. Under the newly-formed Dept. of Commerce and Economic Div., a Raw Materials Advisory Committee has sponsored aerial magnetometer work over a large area which had interested two iron ore companies. This unusual and successful State effort is only part of an overall program of minerals inventory and geologic mapping being carried on.

Probably the liveliest session of the meeting, chaired by J. C. Kieffer, Program Chairman of the meeting, began when he called on former Congressman Graham Barden of North Carolina to speak on labor law. This stalwart veteran of 26 years in the House had just come from a visit at the nation's Capitol where he likened his sensations of end-of-term maneuvering to the old timer walking around town with a rope. When stopped and asked by a friend where he found the rope, he replied that he wasn't sure whether he had lost his mule or found a rope. Tying up the package, "Battling" Graham advised that much poor legislation by Congress could be avoided by setting a closing date and then terminating two weeks early.

Pounding his palm, Mr. Barden emphasized that "there is strong industry and strong union in this country, but they should not be at each others' throats." He thinks that unions work at their jobs, but he was not sure whether industrial management did. Two directions of effort were pointed out: the need for "representative" committees in Congress which he believed were now lacking; and secondly, curtailment of government administrators' arbitrary interpretations of the acts of Congress which effectively add to the law.

The round of applause for Graham Barden had scarcely ceased when the Hon. John H. Dent, Representative from Pennsylvania, hove to at the microphone. In deceptively dulcet tones he pointed to the amendment to the Foreign Aid Act which prohibits the expenditure of the taxpayers' money for the erection of manufacturing facilities or agricultural enterprises in which more than 20% of the product would be exported back to the U.S. Vehemently opposed to the 20% capitulation to the State Department, he thundered that his amendment helped prevent the U.S. taxpaying businessman "from buying himself out of business!" Representative Dent's talk entitled "Effect of Foreign Competition on American Industry and Labor" was a scorecard of names, places and numbers of inroads made by imports. From his restrained beginning, he became a carnival barker deftly producing, one after another, an endless stream of cutlery designed by foreign manufacturers to circumvent those import restrictions on stainless steel which were established to relieve our own squeezed producers. "The definition of an underdeveloped country is one which exports raw materials and imports manufactures," he boomed. He then proceeded to catalog the raw materials exported by the U.S. and the finished products made from them which are returned to compete on domestic markets. Manufactured imports emanate from foreign cartels and industrial combines which would be illegal in the U.S., and which pay trifling wages. A powerful lobby group of import-export people and foreign representatives smooth the way in Washington. Representative Dent warned that we ourselves must be strong if we wish to aid underdeveloped countries.

"Steady on" is the message of this panel on the state of the mining industry. Left to right: R. M. Foose, SRI; C. L. Wilson, Emergency Lead - Zinc Committee; R. L. McCann, N. J. Zinc and session chairman; W. L. Rice, Reynolds Metal; James Boyd, Copper Range; C. B. Jacobs, Inland Steel; D. L. Francis, Princess Coals; and S. H. Williston, Cordero Mining Co. Panel members pay close attention to Mr. Rice's remarks about the aluminium industry. (See below for a summary, as well as for other reports.)

It wasn't all work as witness Robert M. Von Storch with his catch—the winning and only salmon of the day—his helpers, Mrs. Ray Johnson left and his wife beside him. Ribboned derby committeemen shown above are E. G. Easterly and P. A. Dempsey, who weighed in the catch.

There appears to be a trend toward encouraging participation of employees in politics by corporate management. P. J. Hillings, the regional, civic and government affairs manager of Ford Motor Co., said that such programs left the individual free to work in the party of his choice. Management is said to be encouraging this movement by courses on practical politics and giving time-off to participants. The objective of these programs is better and more representative government.

In review of the state of the industry there is an aura of stability and a hard core of determination to meet competition. James Boyd, President of Copper Range Co., cited stability in the price of copper over the last two years and a percentage shift to greater consumption in Europe coupled with wider distribution of production as factors which pointed to a healthy copper industry with growth prospects.

Clark L. Wilson, Chairman of the Emergency Lead-Zinc Committee, pointed to steady production and price in lead for the year and, enigmatically, to zinc moving into a period of "profitless prosperity." He called the Department of Interior position on lead and zinc sympathetic but State Department-sponsored barter subsidies to foreign producers as being inimical to a healthy domestic industry.

An over abundance of iron ore for at least ten years was the prediction of Carl B. Jacobs, Vice President of raw materials, Inland Steel Co. Competition from aluminum, glass, plastics and concrete has made inroads on steel consumption. The key to meeting competition is in low blast furnace cost. The long-range steel industry growth which he sees is tied to maintenance of cost by increased blast furnace output, a brake on labor costs and an equitable tax structure, both State and Federal. He stressed the importance of high grade blast furnace feed and Canadian ores tributory to U.S. furnaces.

Walter L. Rice, President of Reynolds Mining Corp., tied aluminum prospects to the economy of the nation. A spurt of 25% or more in aluminum shipments could result as new billions go into payrolls from stepped up spending by the Government in housing, armaments, etc. Idle primary aluminum capacity in the order of 500,000 tons has created stiff price competition, cutting deeply into profits in 1960 and early '61.

Mr. Rice discussed the interest of U.S. companies in investing in production facilities abroad to meet expected market growth in Europe and other areas. World enthusiasm for improved standard of living among the burgeoning global population spells increased markets for aluminum.

Coal bottomed out early this year and David L. Francis, President of Princess Coals, Inc., laid the decline of the last few years to the dumping of foreign oil at East Coast ports and natural gas price undercutting. Simply stated, he moved on to what the coal industry is doing to get back on its 500 million ton annual production target. The National Coal Association has a three-pronged attack on the problem: research, advertising and markets. A new space heater, clean, efficient and cheap, is aimed at the small industry and apartment house market. Mr. Francis also looked for improved markets in years ahead for western and midwestern coal producers as a result of booming power requirements in the western states.

Richard M. Foose, Chairman of the Dept. of Earth Sciences, Stanford Research Institute, said "virtually all the gain in total mineral commodity production in the United States in the past year can be traced to industrial minerals." Nearly all industrial minerals benefit from population growth which has been marked in the U.S. Labor cost is a key factor in low-priced industrial minerals, and Mr. Foose conjectures a shift in such commodities to lower cost producing areas.

S. H. Williston, Executive Vice President of Cordero Mining Co., painted a dismal picture of strategic metals. Manganese and columbium production is shut down here. The single chrome producer in Montana may follow suit. Tungsten production is restricted to captive and by-product operations as is antimony. South African monozite shipped in as ballast has cut rare earth production. Mr. Williston states that "gross value of beryllium in ore required in this country *at present* could only keep a very few small operations alive." He thinks that if improved recovery methods from low grade ore are effective it will be more economic to take them abroad and supply foreign ore.

MINCON EMPLOYS PELLETIZER

TO BENEFICIATE BERYLLIUM ORE

Today's largest producer of domestic beryllium oxide, Mineral Concentrates & Chemical Co., Inc., has recently disclosed the basic outline of its unique process of beneficiating beryllium ores to high purity BeO. This process, known as the Mincon process, is a thermic-flotation scheme which has reportedly resulted in a recovery ratio exceeding 90% and in allowing up-grading of beryllium concentrates to as high as 33%.

Mincon borrowed a step from the iron ore industry by introducing a pelletizing and sintering stage in their flow sheet at the company's mill at Loveland, Colo. This mill, now operating at full-capacity with three-shifts a day, is still undergoing some minor changes and adjustments in the equipment and chemical reagents.

The Loveland plant is processing beryl, bertrandite and bertrandite-bearing greisen. Most of Mincon's ore comes from the U.S. Beryllium Corp. Boomer and Red Skin mines at Badger Flats, Colo., but the company is interested in increasing its sources of ore with new contracts and purchases from other producing mines. At this time, the company has neither the desire nor plans of becoming involved in the actual mining of beryllium ores, but rather, will concern itself entirely with custom ores.

THE MINCON PROCESS AT LOVELAND

At the Loveland plant, ore is unloaded from trucks into a 25-ton capacity hopper and fed to a 6x12-in. Cedar Rapids jaw crusher via a Syntron feeder and a conveyor. The ore is then stored in a series of bins, each bin holding different grades or types of ore to allow proper blending at this stage. The ore then passes through a Jeffery hammer mill where it is reduced to minus 100 mesh. Depending upon the grade of ore at this step, the crushed product is diverted either to direct storage (if grade is high enough) or to a ball mill and flotation circuit for further upgrading in the case of lean ores. In the first case, ore is reduced to minus 320 mesh in a ball mill before being sent by a pneumatic conveyor to a bin for weighing and feeding to a mixing hopper. In the latter instance, a larger 5x7-ft ball mill reduces ore to minus 200 mesh, and the subsequent conditioning tanks and flotation cells produce a final grade of 15 to 30% BeO. This product is then sent to the dryer.

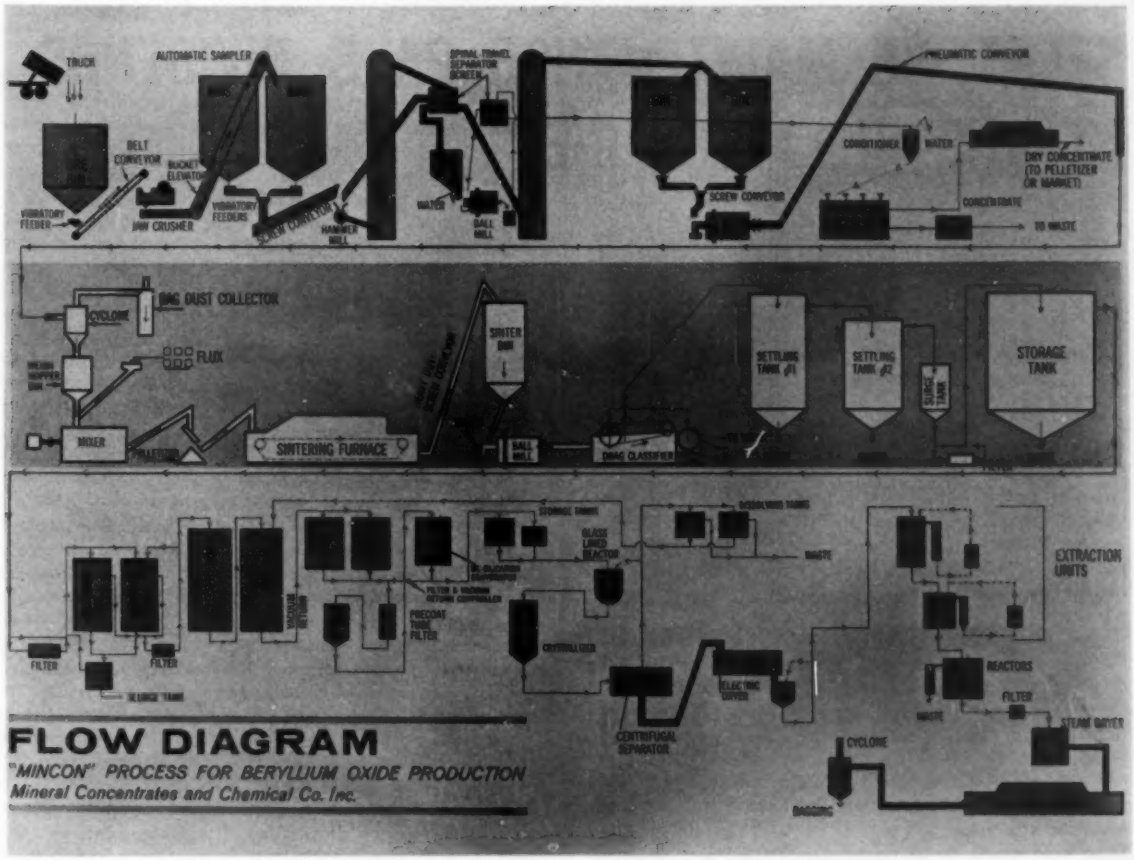
Fluxing agents (sodium carbonate and sodium fluoride) are added to the ore in the mixing hopper and the mixture is then fed to a pelletizer which produces approximately 1-in. diam pellets. Pellets are fused in a sintering furnace at 1750° to 1800°F, depending upon type of ore being processed. As the fused mass comes off the cooling end of the furnace, it goes to a screw conveyor which crushes the product while conveying it to the sinter bin.

The beryllium is dissolved when the sinter is made into a slurry when water and hydrogen peroxide are added. The slurry is then sent to a drag classifier where solids are removed on a Denver 3x5-ft drum filter.

The pregnant liquor containing beryllium plus large quantities of other impurities is pumped to a 5000-gal settling tank for clearing, the liquor in the top portion of the tank being decanted to a 4000-gal settling tank for additional clarification. Pregnant liquor is then pumped via a surge tank through a

A key phase of the Mincon process—placing of raw beryllium pellets in the 1800°F sintering furnace.

H. K. Hee, President of Mincon, and R. S. Myre, Vice President and General Manager, examine beryllium ore.



Flowsheet for Loveland, Colo., plant of Mineral Concentrates & Chemical Co., Inc. which processes beryllium ore to high purity BeO. The process employs flotation to upgrade poorer quality ores. Concentrates are pelletized and fused in a sintering furnace. Chemical processing of the sinter to beryllium oxide is described below. The plant is now operating at full capacity although minor changes in equipment and reagents are being made. Mincon does not operate mines, but processes ore from U. S. Beryllium Corp. and some small miners who operate in the surrounding area.

series of Sparkler plates and frame filters into a 20,000-gal storage tank. At this point, the solution contains from 15 to 20 grams of BeO per liter, plus about 1.5% iron, 2.5% silicon, 1.0% aluminum, 0.5% boron, 0.01% lithium, 0.1% magnesium, as well as other elements.

The clarified solution is pumped through a filter which removes all suspended particles greater than 0.5 micron size. From the filter it goes into the two oxidation tanks where high-pressure air and additional chemicals are pumped into the bottom of the tank to float off contaminants. The purified pregnant liquor is then sent to the primary precipitation tank where beryllium hydroxide is precipitated by the addition of caustic soda. The beryllium hydroxide then goes to a wash tank for removal of some of the remaining impurities.

The beryllium hydroxide is concentrated to a thick paste in the evaporator units before being redissolved in nitric acid. Subsequent triple dehydration and filtration process removes the silicon. The beryllium nitrate solution is then concentrated and crystallized in the special crystallizer designed to produce a very fine crystal. The crystals are sent to a centrifuge where excess liquid is separated from the crystals which are subsequently dried at an extremely low temperature in a controlled atmosphere.

The crystals are re-dissolved in a mixture of alcohol and acetic acid and pumped to the liquid-liquid extraction unit where the beryllium is precipitated from the solution with gaseous ammonia. This process of dissolving and precipitating the beryllium may be repeated two or three times, depending upon degree of purity required.

The resulting beryllium hydroxide is of very high density and all particles are spherical in shape. This is then filtered in an Eimco Burwell filter and placed into a steam dryer. A standard furnace rebuilt to Mincon's specification is used to calcine the oxide. If proper control is made on the solution and the hydroxide before calcining, the resultant oxide has very uniform physical properties. A specially-lined vacuum system is used to pick up the oxide from the end of the furnace as calcination is completed.

Laboratory control is maintained throughout the entire process because of the very fine tolerances that must be maintained on the pH and temperature of the solution at all times. In addition, by using a beryllium analyzer, all control points are kept under the control of one part-time operator.

MINCON EXPANDING OPERATIONS

A 100-tpd concentrate mill is now being constructed in the Lake George area of Colorado to upgrade beryllium ores before sending them to the Loveland plant. Concentrates from this mill will enter the beneficiation process at Loveland at the pelletizing stage of operations, bypassing the earlier crushing and flotation steps. The Lake George plant is scheduled to go on stream in late September.

SELECTIVE MAINTENANCE PAYS DIVIDENDS AT THE IRELAND MINE

by L. S. McNICKLE, JR.

Commonly accepted maintenance methods are being outdated by the rapid acceptance and use of more complicated hydraulic circuitry on modern mining equipment. It is no longer adequate to use the maintenance program to merely repair or sustain equipment operation. Ever increasing operating costs place a huge premium on lost production time. It has, therefore, placed the maintenance programs in the position of being required to alleviate equipment malfunctions on production shifts and still attain the maximum unit life from each component part.

Ireland mine of Hanna Coal Co., which operates two production shifts and one maintenance shift per day, performs hydraulic maintenance with a plan that is geared to assure the bulk of work being handled on the midnight or maintenance shift. Production is thus allowed to continue without interruption from major hydraulic component malfunction. The plan is called *selective maintenance* because the specific part to be worked on and the time the work is to be accomplished are selected according to a definite plan.

Selective maintenance is divided into six phases: 1) scheduled component parts checks; 2) unscheduled component parts checks; 3) component part check record evaluation; 4) component part change out and circuit revision; 5) component part rebuilding and testing; and 6) engineering.

SCHEDULED COMPONENT PARTS CHECKS

This is the key phase in the selective maintenance plan. It is the method used to establish and maintain a complete record of all vital hydraulic component parts in service in the mine. A skilled mechanic is designated as the hydraulic check mechanic. Working on the maintenance shift, he uses a portable hydraulic volume tester in conjunction with a recently developed compact dual pressure gauge unit. The check mechanic is assigned to a different section of the mine each shift and establishes, for record, the condition of hydraulic component parts in that section. All data collected by the hydraulic check mechanic is recorded on printed forms and returned to the hydraulic engineer and master mechanic for evaluation.

Example of Check Procedure: The Joy 5-CM miner employed at Ireland mine has two multistage gear pumps. Each stage of each pump is checked for volume at the pump, excluding all other components from the circuit. This volume check is made at 0 psi and at 1500 psi, the load being applied by the portable tester. The data collected will quickly indicate the slippage and wear losses present in each pump. The portable tester is then installed in the tram circuit between the tram valve and the hydraulic tram unit. A volume check for each tram valve section is made at 0 psi, 1250 psi, 1500 psi and at maximum tram pressure settings, usually 1750 psi to 1800 psi. A clear indication of the condition of the tram valve is thus found. A positive indication of the pressure at which the tram relief valves begin to open and an accurate determination of the volume available for work at each chosen pressure is found. These factors are usually adequate to indicate the condition of the tram motor. If proper pressure and volume are in evidence, and erratic or slow tramming characteristics are present, the tram motor is definitely pointed out as faulty or questionable. The miscellaneous, sump and shear valves are checked in an identical manner and component part weakness beyond the checked unit are easily and quickly spotted.

The roof bolter circuit valves are a continuation of the previously described checking plan. However, the extreme importance of the correct roof bolt torque requires complete accuracy in the pressure setting of the bolter torque motor. Therefore, a torque wrench is used to assure that 150 to 160 ft-lb is available at the check of the bolter motor. The pressure required to produce 150 to 160 ft-lb torque is the measure of torque motor condition. The existing data indicates 1600 psi to be the maximum pressure at which bolter torque motor may be operated and still be trusted to constantly deliver 150 ft-lb torque at the bolter chuck. Should the check indicate that pressures in excess of 1600 psi are needed to maintain 150 ft-lb, the torque motor is deemed faulty and returned to the surface shop for rebuild.

The compact dual pressure gauge unit is employed in setting all system pressures. This unit is fail-safe and completely protected against over pressurization. As a result, continued accuracy is assured. Many units are in use throughout the mine. They are readily available for use on production, as well as maintenance shifts.

A vital control of system pressures is achieved by the work of the hydraulic check mechanic. In addition to maintaining a condition report on all component parts, he limits the pressure settings of the hydraulic units to a level to maintain proper operation but not high enough to cause premature failures. As in every coal mine, a certain amount of unauthorized tampering with pressure settings is prevalent. The hydraulic check mechanic minimizes this human element by assuring production personnel that the machine is properly set up. The growing confidence in the check mechanic's work has greatly minimized unauthorized adjustment of hydraulic pressures.

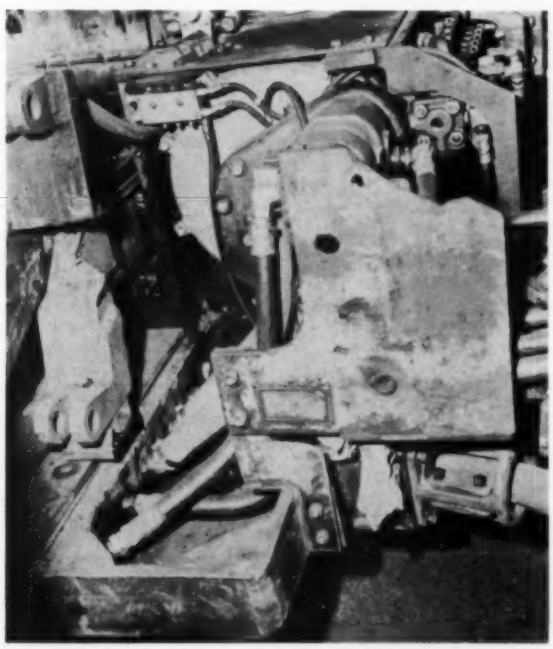
L. S. McNICKLE, JR. is Hydraulics Engineer, Hanna Coal Co., Cadiz, Ohio.

UNSCHEDULED MAINTENANCE CHECKS

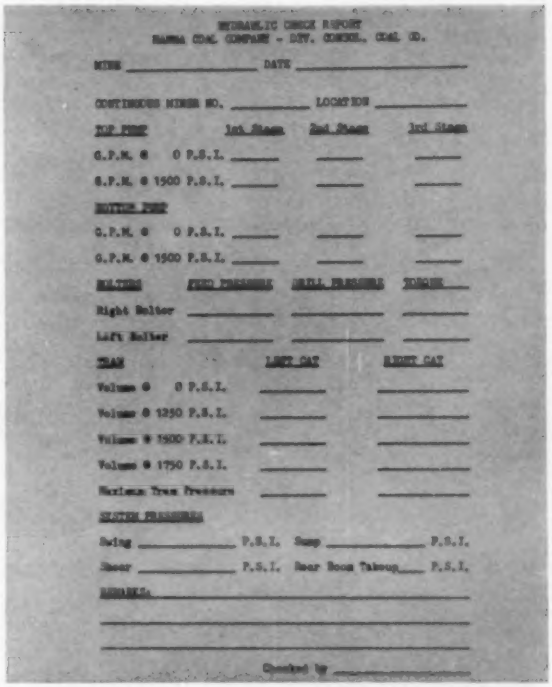
This phase is used as a stopgap measure and is administered by the section mechanic or maintenance supervisor of each operating shift at Ireland mine. In addition to replacement of ruptured hydraulic hoses, maintaining hydraulic oil reservoir and other mechanical problems, the individual section mechanic, by employing the aforementioned dual gauge pressure unit, will make individual pressure checks and minor pressure adjustments during a production shift. This phase is regarded as a minor sustaining phase and is employed to maintain operation with a minimum amount of delay. The alterations performed must be of short time demand and not detrimental to the overall aim of long life for hydraulic and mechanical component parts. The shift maintenance supervisor must approve any deviation from the established plan. Since the beginning of the selective hydraulic maintenance program, the section mechanic's instances of hydraulic trouble have been greatly minimized. A hydraulic cylinder change out, which is a minimum time consuming chore, is the most serious maintenance of hydraulic components attempted during a scheduled production shift. It must be noted, however, that all section mechanics are rotated through three shifts and, as a result, each man serves one third of his time on the pure maintenance shift. He is thus adequately familiar with all maintenance procedures and quite able to cope with problems confronted on the scheduled production shifts.

MAINTENANCE RECORD EVALUATION

This aspect of the maintenance program begins with the delivery of the hydraulic check mechanic's report to the hydraulic engineer and the mine master mechanic. A complete record of each check of hydraulic component parts is retained so long as that part is in service. The facts of the latest report



A well cut into the hydraulic tank allows suction lines to be quickly installed and maintained. Suction problems have been minimized by assurance of tight connections.



HYDRAULIC CHECK REPORT
Hanna Coal Company - Div. Consol. Coal Co.

MINE _____ DATE _____

CONTINUOUS MINER NO. _____ LOCATION _____

TOP PUMP	1st Stage	2nd Stage	3rd Stage
G.P.M. @ 0 P.S.I.	_____	_____	_____
G.P.M. @ 1500 P.S.I.	_____	_____	_____
BOTTOM PUMP			
G.P.M. @ 0 P.S.I.	_____	_____	_____
G.P.M. @ 1500 P.S.I.	_____	_____	_____

MOTORS	PUMP PRESSURE	DRILL PRESSURE	TORQUE
Right Roller	_____	_____	_____
Left Roller	_____	_____	_____

TRAM	LEFT CAT	RIGHT CAT
Volume @ 0 P.S.I.	_____	_____
Volume @ 1250 P.S.I.	_____	_____
Volume @ 1500 P.S.I.	_____	_____
Volume @ 1750 P.S.I.	_____	_____
Maximum Tram Pressure	_____	_____

GATHER PRESSURES

Swing _____ P.S.I. Dump _____ P.S.I.

Boom _____ P.S.I. Rear Boom Takeup _____ P.S.I.

REMARKS: _____

Checked by _____

The hydraulic check report, key to selective maintenance.

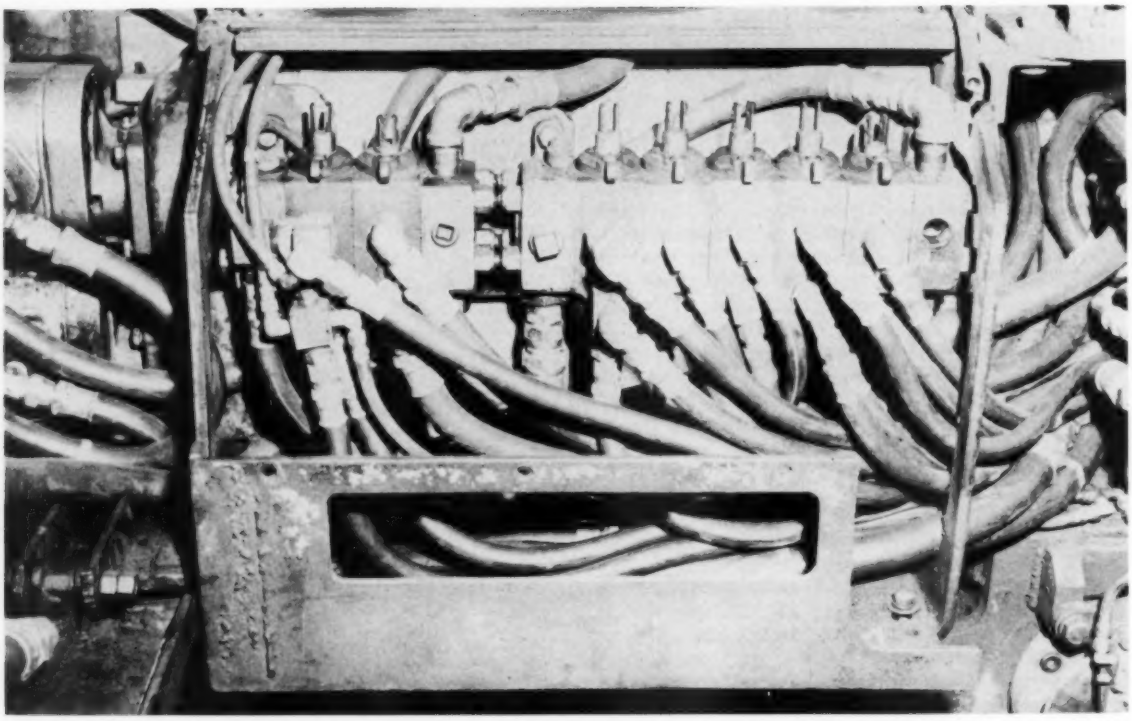
are then compared with the previous data and adherence to the previously developed life cycle pattern is either confirmed or disproved. By careful evaluation, potential life spans of pumps can be reasonably predicted and long range plans made to select the most advantageous time to change out a specific unit before a malfunction or failure can cause a production delay or slowdown.

By virtue of the established methods of checking component parts, careful study of records will create a complete awareness of gradual decline or weakness of the hydraulic system. Small variations, such as a decrease of one gpm effective flow through a relief valve or a noted increase of 25 to 50 psi needed to maintain a torque setting, are indicators that allow the master mechanic to schedule the time to remove or repair the item selected by records as most likely to fail or cause slow operation.

COMPONENT PART CHANGE OUT AND CIRCUIT REVISION

This is the major sustaining phase of the maintenance plan. Proper scheduling, fostered by the opportunity to select the danger spots, allows better utilization of labor and efficient, precise work. The omission of crash maintenance programs are greatly minimized, and a more effective change out of hydraulic component parts is realized.

A considerable amount of circuit revision and adaption is done under two night maintenance supervisors. By close association with the hydraulic engineer, the maintenance supervisors are constantly involved in informative discussions and are being painlessly saturated with hydraulic knowledge and reasoning that is difficult to attain on a formal instruction plan. By virtue of their close association with the mechanics, they are able to spread the gospel of desired hydraulic knowledge and information among the entire maintenance staff in an informal but effective manner.



The divided valve bank, shown above, provides additional return line ports. In addition, this system decreases back pressure and allows rapid wear valve units to be repaired without the risk of disturbing the slower wearing parts.

COMPONENT PART REBUILDING AND TESTING

This is an extremely critical part of any maintenance plan. Maintenance is never better than the replaced component parts.

A reasonably complete hydraulic test bench is maintained at Ireland mine. An integrated electric motor, hydraulic motor, hydraulic pump unit with connected monometers, gauges, pressure and temperature are used to check the bulk of questionable and rebuilt equipment. Currently the hydraulic test bench is staffed by one mechanic, with additional help supplied if and when peak demand conditions develop.

The most critical phase of the rebuild program encountered at Ireland mine has been the rebuilding of the multi-stage gear pumps and hydraulic motors used on the 5-CM miner. At the beginning of the selective maintenance program, pump life was completely unpredictable. A rebuilt unit would have a life expectancy of one hour to several months. As a result, the entire maintenance program was a rather chaotic one. A heavily concentrated study of the pump design, the application and conditions of service and the rebuild program was launched. As is to be expected, each of the above mentioned items contributed its share to the overall poor pump and motor life pattern.

The pump and motor rebuild program, although not guilty of glaring faults, was found to be using methods which, at the least, were debatable. The first step in realizing longer pump life was, therefore, concentrated on removing every possible fault in the rebuild program.

It must be realized that a gear pump, to produce the high degree of efficiency advertised and expected, must run at extremely close tolerances. Establishing and maintaining tolerance limits were thus the first corrective measures. Individual parts, used in pump rebuilding, are measured, and those outside the tolerances prescribed are rejected and returned to the supplier. Methods of pump assembly, pump run in and pump test were evaluated and revised to remove any practice which could be conducive to premature pump failure.

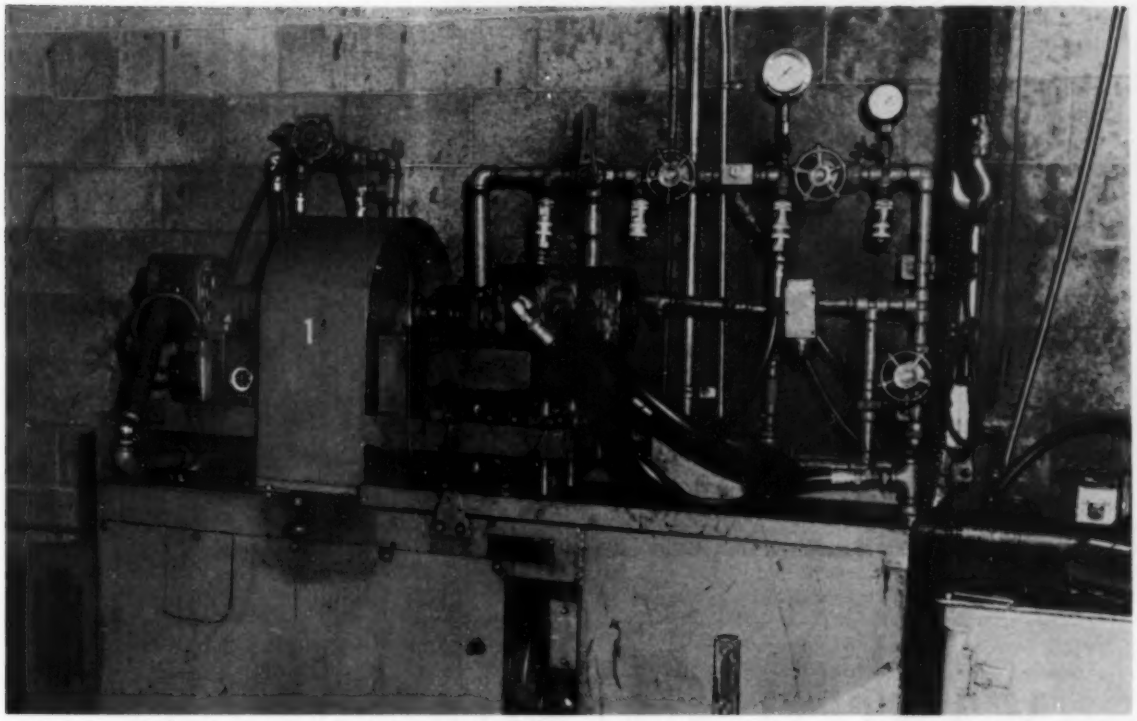
Rebuilding of control valves is currently limited to replacement of seals, springs, detents, intersection gaskets and readjusting torque on assembly bolts to the proper limits. Resizing of worn valves is handled by an outside firm, and the valve units are completely checked on the hydraulic test bench and must pass strict tests before they are approved for service in the mine.

Hydraulic cylinder rebuilding is limited to replacing packing, gland and piston, resizing of piston heads to provide proper clearance and machining replacement piston rods. As in other phases of rebuilding, once it had been established that the program was operating on a sound basis, engineering was begun to devise alterations to promote longer, more predictable life.

The records of each part rebuilding performed are maintained by the hydraulic rebuild mechanic to provide definite patterns of component parts of various manufacture. These records have proven invaluable in selecting the items for purchase which will best perform under the conditions of the Ireland mine.

ENGINEERING

Although listed as the final aspect of the selective maintenance program, and being the final work in most cases, engineering predominates in all phases of selective maintenance of hydraulic equipment.



Testing of rebuilt and questionable equipment is handled on a shop-located hydraulic test bench. In the mine, a dual pressure gauge unit and portable circuit analyzer are the primary tools employed by the hydraulic check mechanic.

Engineering must be the watch dog, the consultant and crutch for each application and problem.

The plan of selective hydraulic maintenance was conceived by the engineering department at Ireland mine primarily to allow usage of the more exacting and predictable practices of engineering. Selective maintenance aids, and is aided by, engineering.

As previously mentioned, the most critical phase of maintenance in the past was the hydraulic pump and motor life expectancy pattern. Engineering studies effected changes in the acceptable tolerance ranges of component parts and emphasized the importance of maintaining the required tolerances. Studies of wear patterns of pumps, examined after predetermined periods of typical service, were used to eliminate component parts which, due to manufacturing practices or design faults, were not producing a predictable life pattern.

Destruction tests were performed to discover component part reaction to specific conditions of loads and application. Pressure pattern studies were made and translated into compatible mining cycle operations. Bearing life, due to loads per in. of gear at normal expected ranges, was established by theory and confirmed or denied by actual test. Comparison tests were run on every type and manufacture of bearing adaptable for operation in the pump. A complete hydraulic circuit study was made and changes evolved to allow the operation to be sustained and maintain the desired work level, at the lowest possible system pressure. Inadequate reservoir conditions were corrected. Completely unreliable suction filtration was replaced with return type filtration of the 25 to 35 micron initial partial selection. A completely filtered filling system was installed and doubtful suction line conditions were revised.

Fluid transmission lines, pressure and return, were resized and rearranged to approach more reasonable velocity rates. Relief valve types and locations were altered to provide smooth, accurate control patterns, and the maximum and minimum limits of volume and pressure were positively proven and firmly established as guides by which to base the selective hydraulic maintenance program.

The current end results of the engineering studies, aided by selective maintenance, are good and the rewards great. We are now experiencing a pump life pattern that allows us to predict three months as minimum with 4½ to nine months attainable under ideal conditions. Operations are no longer plagued by unexpected pump failures on a production shift. The advance of testing and evaluating methods remove the instances where a pump is replaced only to find eventually a control valve, relief valve, cylinder or torque motor was the real item of fault.

SUMMARY

The overall picture has brightened considerably. The "burdened" feeling of maintenance is being replaced by a "confident" feeling of maintenance. Perhaps this could be called "Human Engineering" whereby we devise a plan a man can understand, and by following, feel an immense sense of participation. Maintenance can never rise above the plan it follows, the people who administer it or the quality of the component parts it uses.

At Ireland mine the plan of selective maintenance of hydraulic component parts is answering the indicated needs. Its purpose is clear and exact. Its methods elevate maintenance people by education and by creating an awareness of participation, and its demands regulate the quality of the replaced component parts.

Seated on the top step (center) with his hat in hand, Thomas A. Edison's thoughts may have been on his latest mining venture. At this time, he and "Major" McLaughlin (top row, second from right) were the primary figures in the story that unfolded when the famed inventor announced . . .

"WANTED, A PLATINUM MINE"

For $100 a month plus expenses, Thomas A. Edison in 1879 hired a colorful adventurer named Frank McLaughlin to go west as a prospector. A few months later, McLaughlin triumphantly returned to the inventor's laboratory in Menlo Park, N. J. "On his shirt bosom and fingers sparkled glittering stones," recalled one of Edison's associates. These were only the tangible parts of his new trappings. In addition, McLaughlin "now wore the title of major which he acquired somewhere west of Omaha."

"Major" McLaughlin had struck it rich—but not for Edison. His trip, for the Wizard of Menlo Park, was a wild goose chase. McLaughlin had found gold. Edison was looking for a metal much more precious to him—platinum.

Platinum, at that time a seldom-used metal about which little was known, was an essential part of the incandescent lighting experiments which Edison had been conducting for two years. The first complete lamp he made, in October 1878, contained a platinum filament; he also used the metal for the lead-in wires of his bulbs.

"No one can guess how many platinum lamps he tested during these experiments or how many times he sat there till past midnight poring over them," a colleague wrote.

Edison used platinum as the filament material to be heated to incandescence because it has a high melting point and conducts electricity well. He found it the best metal for the lead-in wires, which carry the electric current into the lamp to the filament, because platinum and glass expand at about the same temperature, providing a good seal at the base of the bulb.

But platinum was hard to obtain. At one point, Edison purchased old batteries to recover the platinum they contained for use in his lamp experiments. Fearing that the small world supply of platinum wouldn't meet the great demand he predicted for the soon-to-be-born electric lamp industry, he launched his own private world-wide search for new sources. McLaughlin's trip was only one phase of this extensive, expensive hunt which aroused great interest on three continents.

Although Edison was only 32 at the time of the 1879 platinum search, he already had made a name for himself with his phonograph and stock ticker. When he spoke, the nation listened and believed, as evidenced by a newspaper article of the day which stated: "He has a fame as an honest inventor which causes all who have taken note of his career to have faith in any statement he deliberately makes."

"He is a man who cannot afford to trifle with the world or his own reputation," the newspaper stated in reporting his hunt and what it termed Edison's announcement that "he is bringing to completion the work of solving the problem of electric light." "The electric light, then, is a settled thing," the report unhesitatingly declared.

And, just as positively, it went on to assert: "If platinum is the only thing now wanted for the general introduction of the electric light, we may be sure the platinum will be forthcoming. Every necessary demand always finds material for supply."

Edison himself was even more confident he would find plenty of platinum and had given such assurance to his financial backers, the stockholders in the new Edison Electric Light Co.

It was one of the few times he was wrong. In May, 1879, he wrote: "I think the U. S. contains all the platinum we desire." Five months later, when his search was in full swing, his faith in it was even greater.

According to a *Scientific American* report: "Mr. Edison thinks he can get three thousand pounds a year from Chinese miners in one locality. One gravel heap is mentioned from which a million ounces of platinum are expected. Hitherto the product of the entire world would not suffice to supply electric lamps for New York City. Mr. Edison believes that our gold mines will supply more than will be required."

How wrong Edison was can be seen in today's annual world production for all the platinum metals —platinum and the lesser-known palladium, ruthenium, rhodium, iridium, and osmium. It is little more than the million ounces thought to be in the "gravel heap."

Edison was basing his hopes on 3000 replies to a circular he widely distributed requesting information on sources of platinum, which was still known at that time by its original name of platina. One reply from Canada, for example, may have been the basis of the supply estimate above. It reported that Chinese miners in British Columbia "are said to throw loads of platina away."

Edison's pursuit of platinum was as thorough and detailed as his scientific work. He mailed 1800 of his circulars to mining camps in this country, alerting prospectors to the fact that platinum sometimes is found with gold, and to U. S. and foreign officials in South and Central America, as well as to Europe including Russia.

Printed with Edison's newly-perfected electric pen, the circular politely inquired: "Would you be so kind as to inform me if the metal platinum occurs in your neighborhood?" Edison explained that he required platinum in "large *quantities* for my new system of Electric lighting." (The capital "E" was his.) In addition, Edison sent out cards sprinkled with small particles of the metal to identify it for the miners.

The platinum search also was well publicized in newspapers. The *New York Sun* headlined Edison's appeal: "Wanted, a Platinum Mine—Thomas A. Edison Willing To Spend $20,000 On Search." The press reported that Edison was willing to finance platinum mining operations, precipitating a flood of replies. One Kansas newspaper went so far as to announce that Edison was offering a $25,000 reward for a good platinum find.

Many men offered to sell the inventor their mines or shares in their stakes. Others offered themselves for hire as platinum prospectors here and abroad. One Samuel Howard of Silver Reef, Utah had a problem which topped his financial one. He wrote: "I feal confident that had I the means I could find it for you. But the means I do not posess. And the cunty is a hard one to prospect in on accunt of the Indians." He obviously had a spelling problem.

Every letter received by Edison in Menlo Park was answered by his secretary after the busy scientist made notations on each one in his usually meticulous, but sometimes scrawling, abbreviation-ridden handwriting. Every sample of ore shipped to Menlo Park by eager miners was tested by an assayer hired especially to handle the heavy load. Few specimens were found to contain platinum.

"Say no platinum in samples—try again," Edison noted on one letter.

Most of the letters he merely marked "No PT," using the symbol for the metal. At one point, he seemed to have become annoyed with a rash of letters claiming platinum was found in Georgia. "When they get hold of an ore down there they don't und, (apparently his abbreviation for understand) they call it pt," he scribbled.

Many experienced miners reported that platinum didn't occur in their areas, occurred in quantities unprofitable for mining or went unrecognized. "Platinum is comparatively unknown to the ordinary miner," wrote a Dakotan, "and would in the majority of instances be treated by them as black sand and thrown away without notice."

Platinum, at the time, also was still unwanted in Colombia, where the 16th century Spanish conquistidores first discovered the white metal and gave it its name and where the Indians had ignored it for centuries. "The natives will not pan platina at $50 a pound when they can get $200 per pound for gold," a mining company told Edison. Platinum is worth more than gold today—$75 an ounce as compared to $35 for the yellow metal. In 1879, Edison paid $7.50 for an ounce of refined platinum.

A New York attorney who had visited Colombia in the mid-1800's wrote Edison that he had seen much of what he called "Platenium" there, but, like the natives, had disregarded it because it brought low prices. "Had I been possessed of the knowledge acquired in after years," he lamented, "at the time of my travels I could have made a very large fortune by recovering the tenth part of precious metals thrown away by native miners."

Edison followed up every lead in the letters he received. He sent McLaughlin to Canada and the West and another agent to the South. Other experts were hired on the scene at promising mining areas to collect ore samples. While the unsuccessful search for platinum was going on, so was Edison's search for a practical incandescent lamp. This proved fruitful on October 21, 1879 when Edison's first successful lamp burned for 40 hours. Ironically, this lamp, which marked the start of the electric light era, didn't have a platinum filament. Edison had abandoned the metal as filament material not only because it was expensive and scarce, but because it was short lived and consumed too much energy in proportion to the light it gave. His first practical lamp contained a simple carbonized thread filament.

It did, however, still contain platinum in the lead-in wires. No substitute metal for this purpose was found until about three decades later, somewhat justifying Edison's prediction for the great need for platinum in the lamp industry. Before base metals were developed for lead-in wires, the demand for platinum in bulbs was so great that by 1890 the price was driven up until the metal accounted for one-third the cost of the entire lamp.

Thus, although Edison failed to find platinum, he did succeed in finding a substitute filament material which enabled him to give the world the electric light. And the great inventor himself received a fitting memento of his fruitless platinum search. His old friend, the grateful "Major" McLaughlin, presented Edison with a walking stick. Set in its knob was quartz sparkling with bits of precious metal—not platinum, but gold from the "Major's" mines!

COPPER SEGREGATION PROCESS SHOWS PROMISE AT LAKE SHORE MINE

by G. A. FREEMAN, CARL RAMPACEK and L. G. EVANS

A large aggregate tonnage of oxidized and mixed oxide-sulfide copper ore of the southwestern U.S. is not amenable to conventional flotation concentration or sulfuric acid leach treatment. Most of the ores contain chrysocolla as the principal oxide copper mineral, for which no successful commercial flotation method has yet been developed. Acid leaching some ores is not feasible since they contain substantial quantities of calcite and other acid-consuming constituents. Other ores decrepitate during leaching or contain excessive slime and clay minerals which cause plugging of the ore beds.

Research at the U.S. Bureau of Mines' Tucson Metallurgy Research Laboratory over the past several years demonstrated that the segregation process had merit for treating oxidized and mixed oxide-sulfide copper ores regardless of the gangue constituents present, or the physical characteristics of the feed.[1,2]

Small-scale pilot-plant tests performed by the USBM and by Transarizona Resources, Inc., further demonstrated that the process was applicable to the highly-calcareous and iron-bearing oxide ore occurring in the Lake Shore deposit near Komelik, Ariz. Based on test results, the company began erection of a 175-tpd experimental segregation plant to further test the process in December 1959. Construction of the plant was completed in May 1960, and shakedown operations were started in June 1960.

Briefly described, the segregation process comprises heating and oxidized or mixed oxide-sulfide copper ore with a halide salt and a carbonaceous material, such as coke or coal, at approx 1400° to 1500°F. Segregation produces fine metallic copper which can then be recovered by conventional copper sulfide flotation methods. Although numerous reactions are involved in the process, basically the copper is volatilized from the copper minerals as cuprous chloride and then reduced to metallic copper on the surfaces of the carbonaceous particles. The fine flakes often agglomerate forming nodules as long as ¾-in. and ½-in. in diam. These nodules, however, immediately fall apart with agitation. A more complete discussion of the process and its application to oxide and mixed oxide-sulfide copper ores is given in earlier reports.[1,2]

LAKE SHORE MINE

Lake Shore mine is located at an elevation of about 1800 ft on the southwest piedmont of the Slate Mountains, about 30 miles south of Casa Grande and 3 miles east of Komelik, Ariz. A shaft was sunk in the deposit in the period 1880 to 1884. Ore was produced sporadically from several shafts and three development levels in the deposit in the period between 1884 and 1929, when the last reported production was made. Total production from the mine is reported to have been approximately 280,000 lbs of copper.[3]

Although previous *high-grading* operations employed underground mining, the deposit is now being mined by the open-pit method. Part of the north orebody has been stripped of alluvium down to a depth of about 30 ft to expose enough ore for several years of operation. Drill holes are spaced in a pattern of 5 to 6-ft centers; use of ammonium nitrate readily breaks the ore to about 10-in. in size. Load-

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The 175-tpd experimental plant of Transarizona Resources, Inc., (above) is now being replaced by a 750-tpd plant.

ing is done by a 1-yd front-end loader. The ore is hauled in 10-ton trucks to the segregation plant about 1500 ft southwest of the pit.

The ore being treated is a reddish-colored, magnetite-bearing quartzite which has been fractured and recemented with quartz, chrysocolla, hematite, calcite and chlorite material. The ore is devoid of sulfides, and at times, massive magnetite, enriched in chrysocolla, and considerable calcite is encountered. The grade of minable ore varies from about 1.5 to 2.25% Cu. Detailed development work by rotary drilling has assured the mining and delivery of a consistently uniform feed to the plant.

SEGREGATION-FLOTATION PLANT

The segregation-flotation plant has a daily capacity of about 175 tons of ore containing 3 to 4% moisture, the capacity being limited by the segregation furnace. A flowsheet of the plant as of November 1960, is shown below.

Power is supplied at 24,900 v from the lines of the Trico Electric Co., about two miles southwest of the deposit. A 750-kva transformer substation at the plant site drops the voltage to 440 v for plant operation, and a standby diesel-electric plant provides emergency power for the segregation furnace and calcine cooler during power failures.

Water from a 251-ft well about 2.5 miles west of the plant is delivered to the plant through a 5-in. pipe line by means of a 30-hp pump. Pumping facilities are available to produce enough water to treat as much as 500 tpd of ore. In addition to the primary water source, provisions are being made to recover water from the tailing disposal pond and thickeners. It is anticipated that 50 to 60% of the water will ultimately be recovered.

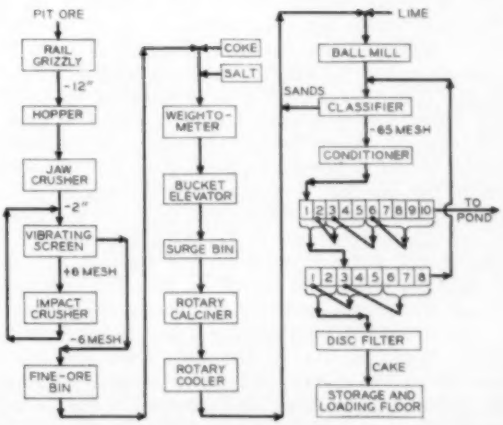
Natural gas, purchased from the Southwest Gas Co. is received at the property through a 4-in line at 150 psig. The high pressure gas is reduced to 20 lbs for plant use.

The ore is dry-crushed to minus 6 mesh for segregation. Coarse crushing is accomplished in a 16x24-in. jaw crusher set at two in., operating in open circuit. The jaw crusher discharge is conveyed and crushed in a 5-ft Tornado impact crusher in closed circuit with a 6-mesh vibrating screen. Rapid and efficient reduction is obtained in the crusher so that the circulating load is light. The undersize particles from the 6-mesh screen are conveyed to a 400-ton, fine-ore storage bin.

Crushing is carried out on the day shift. About 60 tph of ore can be crushed to minus 6 mesh. A typical screen analysis of the minus 6-mesh segregation furnace feed is given in Table I.

SEGREGATION FURNACE

The segregation reactor measures 54-in. ID x 48 ft long with the ends coned to 30 in. inner diam. The segregation unit is fabricated of ½-in. rolled and welded, type-316 stainless steel plate. A refractory brick-lined, natural gas-fired furnace, 31 ft long, encloses part of the reactor. About eight ft of the shell extends from the furnace at the feed end and eight ft extends at the discharge end. Riding rings attached to the reactor shell on either side of the furnace support the reactor. The discharge end outside of the furnace is completely insulated with 4½-in. thick magnesite block to reduce radiation losses to a minimum. Staggered, 3/16-in. stainless steel lifters three in. high and 24 in. long are attached to the inside of the reactor throughout the



Flow sheet of copper segregation process at Lake Shore.

Table I. Screen Analysis of Segregation Feed

Screen Size, Mesh		Wt Pct
	+6	—
−6	+8	4.6
−8	+10	7.9
−10	+20	18.7
−20	+35	16.9
−35	+48	7.3
−48	+65	7.3
−65	+100	7.5
−100	+150	7.1
−150	+200	4.7
−200	+270	4.6
−270		13.4
Composite		100.0

Table II. Screen Analysis of Tailing

Screen Size, Mesh		Wt Pct
	+48	0.4
−48	+65	1.0
−65	+100	5.3
−100	+200	25.0
−200		68.3
Composite		100.0

54-in. diam section to facilitate mixing of the ore charge as it passes through the unit. The reactor is driven at four rpm by a 20-hp motor connected to a speed reducer which drives a ring gear attached to the reactor shell at the feed end. The furnace has a 74-in. inner diam and is equipped with 14 natural-gas burners complete with spark ignited pilots and auxiliary air and gas valves. The gas burners are located at the side and bottom of the furnace, firing tangentially to the rotating shell. Two dampered flues attached to the top of the furnace and near each end conduct the exhaust gases to a single 2x40-ft stack which discharges into the atmosphere.

The furnace is equipped with a complete temperature control system incorporating flame protection features and safety shut-off valves which automatically cut off the natural gas should the external shell temperature exceed a predetermined figure.

The outside temperature of the reactor tube is measured by five thermocouples equally spaced and riding on top of the reactor shell in the heated zone. Another thermocouple indicates the stack gas temperature. These temperatures are recorded on an eight-point strip chart recorder. A sixth thermocouple, located in the ore bed about 21 ft from the discharge end of the reactor, is the principle furnace control. This thermocouple is connected to a circular chart potentiometer which operates a pneumatic control valve which increases or decreases the fuel to the burners, depending on the temperature of the charge. A second thermocouple is installed in the ore bed about 15 ft from the discharge end and also is recorded on the eight-point recorder.

The minus 6-mesh ore from the fine-ore bin and the required quantities of minus 20-mesh commercial salt and minus 48-mesh petroleum coke are fed on a 18-in. x 20-ft long conveyor belt using Syntron feeders. Some mixing of the salt, coke and ore is achieved on the conveyor belt by means of chains and rubber fingers suspended above the belt which drag in the ore ribbon as it passes beneath. The partly mixed feed discharges into a bucket elevator and then into a 10-ton surge bin ahead of the segregation furnace. Mixing of the ore, salt and coke is completed in the elevator. It was found that a thorough mixing of the salt and coke with the ore was very important.

The salt-coke-ore mixture is fed to the segregation furnace at a rate of about 7.5 tph by means of a variable speed 9-in. spiral screw feeder connected to the bottom of the surge bin and extending about three ft into the reactor. A ring seal between the screw feeder and the reactor prevents escape of the reaction gases. An ore column is maintained in the furnace surge bin for air seal.

The temperature of the reactor charge is increased as rapidly as practicable; the outside shell temperature, or more likely the flame temperatures at shell surface, are 1500° to 1700°F. The desired reaction temperature of 1400°F is reached in the ore bed at a point about 22 ft from the feed end and is maintained at this temperature until the ore leaves the heated section. The temperature then drops to about 1300°F as it moves into the insulated section toward the discharge end.

The normal bed in the reactor occupies a cross sectional volume of about 20%. Under the operating conditions employed, the contact time of the ore charge at the reaction temperature of 1400° to 1500°F is about 18 min.

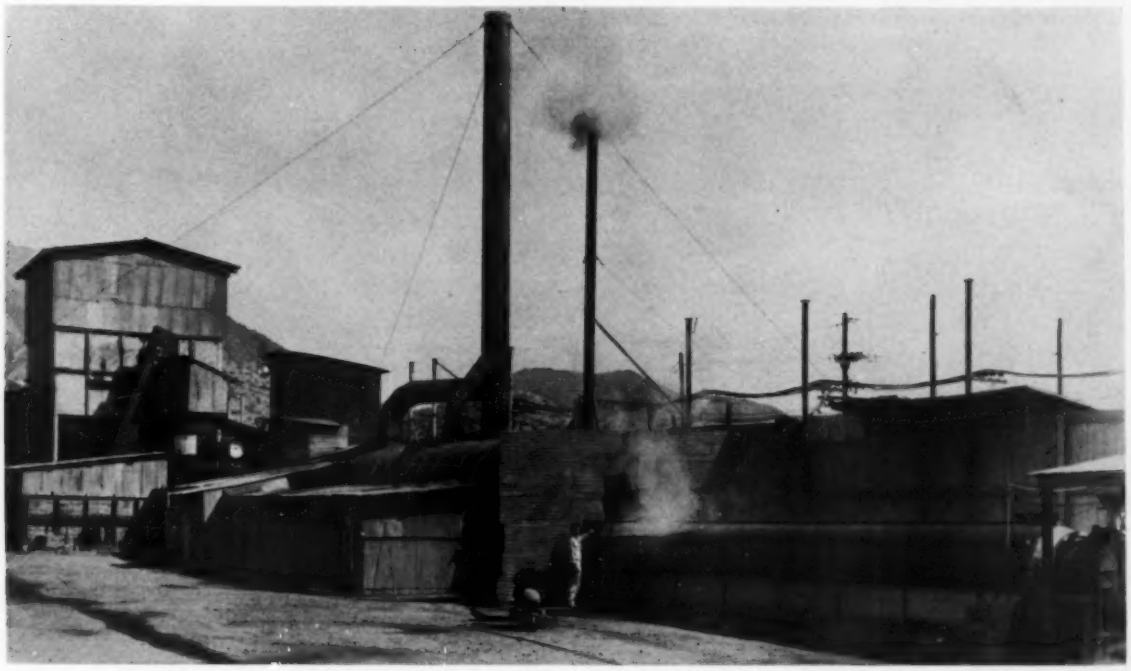
The segregated calcine discharges from the reactor at approximately 1100°F through a vented hood attached to the shell and feeds into a 4x44-ft Baker-type cooler. Moderately gas-tight connections are maintained between the reactor hood and cooler by means of ring seals. Absolutely air-tight connections are not required because the segregation reaction produces steam and reaction gases which develop a positive pressure and prevent entry of air into the unit.

GRINDING AND FLOTATION

The cooled calcine discharges from the cooler at 200°F onto a 18-in. x 68-ft conveyor belt which feeds into a 6x12-ft Allis-Chalmers ball mill operating in closed circuit with a Dorr Duplex Classifier. The grind is controlled to give a minus 65-mesh classifier overflow. The classifier overflow, containing about 25% solids, is conditioned in a 5x5-ft slow-speed conditioner using potassium amyl xanthate, methylisobutyl carbinol and enough lime to establish a pulp pH of 11.5. The conditioned pulp is floated in 10 No. 24 Denver cells. A rougher concentrate is recovered from the first two cells and gravity-fed to the cleaning section. Froth from the next three rougher cells is returned to No. 2 rougher.

Table III. Summarized Results of Plant Operations, November 1 to November 27, 1960

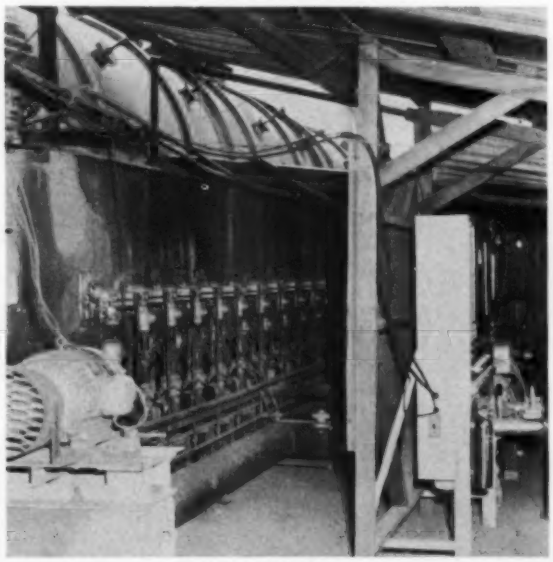
Product	Assay, Pct					Distribution, Pct
	Cu	Fe	CaO	SiO_2	Al_2O_3	Cu
Heads	1.81	13.7	—	—	—	100.00
Concentrate	50.09	3.2	2.6	13.3	0.8	87.15
Tailing	0.23	—	—	—	—	12.85
Reagents						
NaCl		lb/ton ore				28.0
Coke		lb/ton ore				18.0
CaO		lb/ton ore				4.8
Potassium amyl xanthate		lb/ton ore				0.5
Methylisobutyl carbinol		lb/ton ore				0.1
Natural gas		Btu/ton ore				1,900,000



Furnace and calciner at Lake Shore's pilot plant. The new plant will be ready to go into operation this fall.

Froth from No. 6 cell is returned to No. 3 rougher, and a scavenger froth obtained from the final four roughing cells is combined with feed to the No. 6 rougher cell. The final tailing is pumped to a tailings pond 1000 ft away. The average screen analysis of the tailings is given in Table II.

The cleaning section consists of eight No. 18 special Denver cells. The rougher froth is cleaned twice using three cells in the first stage and two in the second. The final flotation concentrate is filtered on a 6-ft disc filter and stored in a bin for periodic shipment to the smelter. The first cleaner tailing is refloated in three additional cells to produce a scavenger concentrate which is combined with the froth from the roughing circuit. These products return to the head of the cleaning circuit, and the tailings from the middling refloat are returned to the Dorr classifier.



Control panel (right) keeps furnace operating properly.

RESULTS AT LAKE SHORE PLANT

Plant operations have been as good as, and in some instance have exceeded, the results obtained in the laboratory and pilot-plant research. A summary of results obtained during a 27-day period during the month of November 1960, are given in Table III. The grade of concentrates produced has consistently improved since the start of operations, and in some cases has approached 65% Cu. Copper recoveries also have improved, and the gas and reagent requirements have gradually been reduced. The gas consumption will be reduced considerably with the installation of pre-heaters using the waste stack gases.

Considerable experimentation was conducted in the plant and at the USBM station in Tucson during the six months of operation ending in November 1960. A number of changes in the original furnace design and simplification of the hot and cool calcine handling system were made before settling on the final flow sheet.

Based on the plant operation and results, the Lake Shore operations now are being expanded to about 750 tpd. The company will install two new furnaces, each of which will have a capacity of ten tph of ore. The capacity of the experimental reactor also is being increased to ten tons by making a number of modifications in both the reactor and furnace design. Three pre-heaters will also be incorporated into the flowsheet to take advantage of waste heat.

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ELECTROMAGNETIC STUDIES OF IRON FORMATIONS IN THE LAKE SUPERIOR REGION

Recently released results of surveys employing the slingram and turam methods show the applicability of electromagnetics in mapping new areas containing both oxidized and unoxidized iron in the Lake Superior region.

by F. C. FRISCHKNECHT and E. B. EKREN

During the summers of 1957 and 1958 the U. S. Geological Survey made experimental electromagnetic studies over several of the iron ranges in the Lake Superior region. The principal objectives of this work were 1) to determine if nonmagnetic, oxidized iron formations in the Mesabi and Cuyuna Ranges could be detected by electromagnetic methods; and 2) to test electromagnetic methods for locating and tracing deposits of magnetic taconite of the type found in the eastern Mesabi and western Gogebic Ranges.

The areas studied included parts of the Cuyuna district and Mesabi Range in Minnesota, and a part of the western Gogebic Range in Wisconsin.

The Cuyuna Range, about 90 miles west of Duluth, Minn., is about 65 miles long and about 25 miles wide at its maximum. A part of the Cuyuna Range is under cultivation and is of low topographic relief. The bedrock is usually concealed by 15 to 400 ft of glacial drift.[1] In the main range in the Cuyuna district, lying north of the Northern Pacific railway, the iron formation is 45 to 500 ft thick[2] and dips at very steep angles. Schmidt[2] divided the formation into two mappable types, a thin-bedded facies and a thick-bedded facies. In the area studied, the two facies overlap and are both oxidized. The rocks consist mainly of soft, red and brown iron oxides and quartz. The iron formation is underlain by a thick series of argillite, siltstone, and lenticular quartzite; and is overlain by dark-colored argillite and slate. The overlying rocks are of particular interest to this study because of the occurrence of conductive graphitic strata in the slate. Harder and Johnston[3] note that the overlying slates often contain a carbonaceous unit adjacent to the iron formation which, in places, is a guide to ore.

Harder and Johnston[3] used the name "Deerwood" for the iron-bearing rocks of the Cuyuna Range.

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Close-up of the ratiometer and receiving coil for use in the slingram surveys over the various iron formations.

More recently, Grout and Wolff[4] proposed that the main iron formation is correlative with the Biwabik formation of the Mesabi Range and that the underlying and overlying rocks are correlative, respectively, with the Pokegama quartzite and Virginia slate of the Mesabi Range.

The Mesabi Range lies along the north limb of the Lake Superior syncline, about 50 miles northeast of the Cuyuna Range. In contrast to the rocks in the Cuyuna and Gogebic Ranges, the iron-bearing rocks in the Mesabi Range are gently dipping (4° to 12° southeastward).

The Mesabi Range is the type-area of the Biwabik formation and, as at Cuyuna, the Biwabik is overlain by the Virginia slate and underlain by the Pokegama quartzite. The Biwabik formation on the Mesabi is composed primarily of alternating and

A group conducting a slingram survey in Minnesota. USGS showed the feasibility of mapping by electromagnetics.

gradational beds of ferruginous cherts and slates. These beds have been oxidized and hydrated in many places on the western and central parts of the range, and the original magnetite and specular hematite have, in the process, been converted to soft hematite and limonite. Weathering or oxidation of the iron formation is rare on the eastern Mesabi Range.

The Gogebic Range, about 90 miles east of Duluth along the south limb of the Lake Superior syncline, lies partly in Wisconsin and partly in Michigan. The iron-bearing formation in the Gogebic range is the Ironwood iron formation, generally considered to be correlative with the Biwabik formation of the Mesabi Range. It is overlain by the Tyler slate and underlain by the Palms quartzite that probably correlate, respectively, with the Virginia slate and Pokegama quartzite. In the area studied (the western Gogebic Range), the rocks are lithologically very similar to those of the Mesabi and Cuyuna Ranges and dip from 50° to about 65° north.

Glacial material composed of sand, silt, clay, and boulders of diverse types of rock unconformably overlies the bedrock throughout much of the Mesabi and Gogebic Ranges, and in places, is over 100 ft thick.

METHODS AND EQUIPMENT

Two electromagnetic methods were tested: the slingram (or loop-frame) method and the turam (or two-frame) method. In the slingram method two small portable coils are used; one is a transmitting coil, the other a receiving coil.[8] An alternating magnetic field is set up by passing alternating current through the transmitting coil. The magnetic field, in turn, induces a voltage in the receiving coil. The magnitude and the time or phase relationships of the receiving coil voltage depend on the electrical conductivity and magnetic susceptibility of the earth. A reference voltage is transmitted directly from the transmitting coil to the receiving coil by means of a cable. A ratiometer and an amplifier-null indicator are used to compare the voltage induced in the receiving coil with the reference voltage. The coils are spaced at a standard distance apart, usually between 100 and 300 ft, and are moved simultaneously along a traverse for each new reading.

In the turam method a long, grounded wire or a large, insulated loop is used as a stationary source of energy.[8] Two small receiving coils that are similar to slingram coils are used. The receiving coils, spaced 25 to 100 ft apart, are moved simultaneously along traverses normal to the energizing grounded wire or insulated loop. The voltages induced in the two receiving coils are then compared by using a ratiometer.

In comparing voltages, two ratios, commonly called the inphase and out-of-phase components, are measured with both methods. The inphase component is that part of the receiving coil voltage that is in phase with the reference coil voltage. The out-of-phase component is that part of the receiving coil voltage that is 90° out of phase with the reference coil voltage.

In the turam method, the ratios measured in the field always are normalized by comparing them with the theoretical ratios that would be measured in the absence of the earth. Turam results may be presented as normalized ratio curves or as normalized field curves which are calculated from the ratios.

THEORETICAL RESPONSES

Theoretically, when traversing over ground or an orebody that is non-conductive but which has significant magnetic susceptibility, the in-phase component will be greater than 100% of its normal value, and the out-of-phase component will be *zero*. On the other hand, when traversing over conductive earth both components will vary in a complex

way. The response due to conductivity, or to a combination of conductivity and susceptibility, depends upon frequency and approaches zero as zero frequency is approached. However, the response due to magnetic susceptibility only is independent of frequency.[6] These effects are illustrated in a qualitative way for the slingram method in Fig. 1.

When traversing directly over a conductor with the turam method, the inphase component is usually less than 100% and the out-of-phase component is negative. As the edge of the conductor is approached, the inphase component is usually greater than 100% and out-of-phase component may be positive.

The same type of response is observed with the slingram method if the conductor is steeply dipping and thin. With the slingram method, if the conductor is wide and highly conductive, the inphase component over the conductor will be less than 100% for a depth of burial less than about 0.3 of the coil spacing and greater than 100% for a depth of burial greater than about 0.3 of the coil spacing. The out-of-phase component will be negative for shallow depths of burial and positive for moderate and great depths. If the conductor is wide and has a low conductivity, the inphase component will be positive at low frequencies and negative at high frequencies. The out-of-phase component will change in a like manner.[7] In general, subsidiary anomalies of opposite sign occur as the edges of a wide conductor are crossed.

In the Lake Superior region, the amplitude of most magnetic anomalies produced by iron-bearing formations depends primarily upon remanent magnetization and does not necessarily reflect the actual magnetite content of the rock. The electromagnetic response, however, depends upon magnetic susceptibility and electrical conductivity only, and not upon the remanent magnetization of the rock.

SLINGRAM, TURAM TRAVERSES OVER OXIDIZED IRON FORMATIONS

About 25 slingram and turam traverses were made over the iron formation in five different localities on the Cuyuna Range, eight were made over magnetic taconites in three different areas in the eastern Mesabi Range, and eight were run in three locations on the western Gogebic Range. Fig. 2 shows electromagnetic profiles along two traverses on the north Cuyuna Range where narrow bodies of enriched iron ore are covered by about 90 ft of glacial drift. The slingram curves shown in the figure were obtained using a coil separation of 250 ft and a frequency of 8000 cycles per sec. The response was about twice that observed for equipment operating at a spacing of 200 ft and a frequency of 3600 cycles per sec. The turam measurements were taken with conventional equipment operating at 500 cycles per sec.

Both the turam ratio and the slingram curves (Fig. 2) are quite featureless except for small anomalies near the iron formation and slate contact. These small anomalies near the contact are similar to those observed over narrow conductors. They are distorted by even smaller conductors, some of them perhaps within the glacial drift, which make a more exact interpretation very difficult. The turam field curve shows a slight change in slope near the iron-formation and slate contact, and the slingram profiles appear more irregular over the slate than over the quartzite. The existence of the iron ore, however, is not evident on the profiles. This result is not too surprising. Electric logging studies by the U. S. Geological Survey[8] show that the iron ores in the areas traversed have a resistivity of about 50 ohm-meters, whereas the glacial till and country rocks have resistivities of about 1000 ohm-meters. Theory and model studies indicate that, with the slingram method, it should be possible to locate an extensive deposit of ore having a resistivity of 50 ohm-meters beneath 90 ft of till provided the body has a width of 200 ft or more, but a zone of this ore 80 to 100 ft wide would be too narrow to be detected.

In testing the turam method on the Cuyuna Range it was hoped that the iron ores would provide a favorable path for the return current flow in the earth between the grounded electrodes. Any appreciable concentration of current in the iron ore would be detectable. Apparently there is insufficient con-

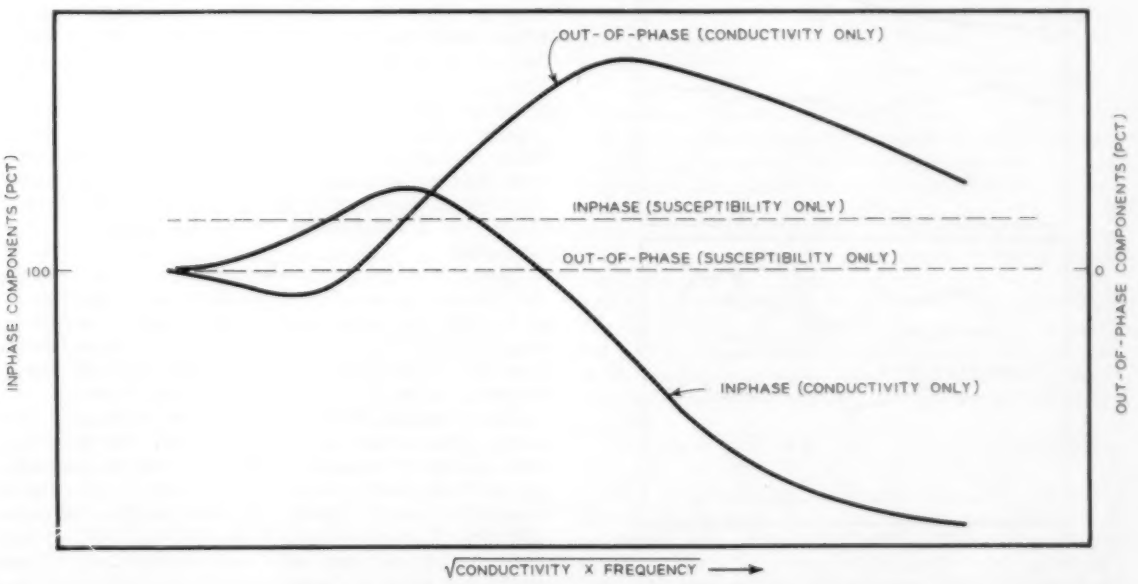

Fig. 1—Slingram response over a homogeneous earth.

tinuity between pods of ore in this particular locality to form a low resistivity path since no significant anomalies were observed.

Not only in this area, but in other areas tested with turam and slingram methods on the Cuyuna Range, small to moderate size anomalies were found consistently over the contact of the iron formation and hanging wall. On most traverses over the Cuyuna Range, the turam field curve changes in slope in going from the hanging wall to the footwall, and there are fewer small features on the slingram curve over the footwall than over the hanging wall. The anomalies at the contact of the iron-formation and hanging wall are probably caused by carbonaceous or graphitic strata in the hanging-wall formation[1]. The overall differences in response between the footwall and hanging-wall formations may thus be attributed to minor graphitic conductors distributed throughout the hanging-wall formation and a lack of such conductors in the footwall formation. It is therefore probable that electromagnetic methods will be useful in tracing oxidized iron formation in those areas on the Cuyuna Range where graphitic strata occur in the hanging-wall formation.

Slingram traverses over magnetic taconites: Slingram traverses were made over parts of both the eastern Mesabi and western Gogebic ranges to determine if electromagnetic methods are a practical means of locating and tracing taconite ore bodies. Electrical logging studies by Zablocki and Keller[4] had indicated that the magnetite-rich taconites have a very high conductivity (as much as 10 mhos per meter) and therefore should be traceable by electromagnetic methods.

Slingram profiles made over such taconites in a section of the western Gogebic Range are shown in Fig. 3. Beneath the slingram profiles are magnetic susceptibility, resistivity, and generalized lithologic logs obtained from two diamond drill holes. The resistivity logs show variations from about 0.1 ohm-meter to 8000 ohm-meters. The susceptibility logs show relative values only.

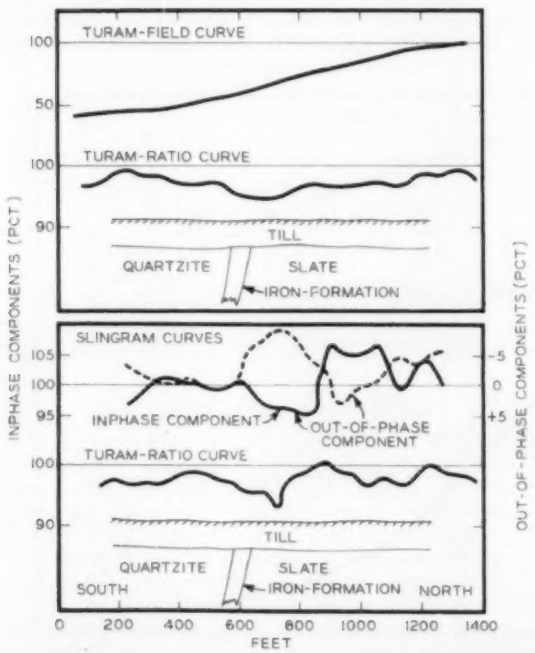

Fig. 2—Turam ratio and slingram curves over iron formation on the Cuyuna Range of the Lake Superior Region.

The measurements were made along two traverses. Along one traverse, coil separations of 100 ft (*A*-100) and 200 ft (*A*-200) were used. Along the other traverse (*B*), located 200 ft west of *A*-100 and *A*-200, a coil separation of 200 ft was used. The slingram equipment was operated at 3600 cycles per sec.

Beginning over the quartzite, the inphase curve on traverse *A*-200 starts near 100%, and the out-of-phase at 0%. Proceeding over the contact with the Ironwood iron-formation, the inphase curve rises to a value of about 130 pct, whereas the out-of-phase stays at about *zero*. Probably most of the rise of the inphase curve is caused by the high magnetic susceptibility of the iron formation. Electrical conductivity of this portion of the iron formation is very low as may be seen on the resistivity log.

Further along the traverse, the inphase curve fluctuates from values greater than 100% to values less than 100% and the out-of-phase curve rises to negative values of 30 to 40%. This part of the iron formation from about 250 ft to 700 ft south, is conductive and, at the frequency used, the effect of the conductivity was greater than the effect of the magnetic susceptibility.

At about 850 ft south, the inphase component rises to a high value of about 140% and the out-of-phase component drops to about *zero*. On the basis of previous discussion, one might expect this change to be caused by magnetic iron formation having very low conductivity and high magnetic susceptibility. However, the resistivity and magnetic susceptibility logs show that this is not true. They indicate that both the magnetic susceptibility and the conductivity are low in this part of the iron formation. This anomaly is apparently an edge effect caused by the presence of two good conductors on either side of a non-conducting portion of ground.

Further along the profile, centered at about 1000 ft and 1350 ft south, are two more anomalies which have inphase components of less than 100%, small negative out-of-phase components, and are separated by a "high." The "high," again, is probably an edge effect due to two conductors, one on either side. The traverse is over slates of the Tyler formation in this vicinity; therefore the anomalies probably are due to graphitic strata within the slates and not to conductive iron formation.

Note that anomalies over the Tyler slate have lower out-of-phase/inphase ratios than anomalies over the iron formation. This may be generally true throughout the Gogebic Range, and if so, would be a means of distinguishing the slates from the iron formation.

There is a good correlation between anomalies on traverse *A*-200 just described, and traverse *B*, and what has been said about traverse *A*-200 is also true of traverse *B*. The correlation marks show how the various troughs and peaks of both components can be correlated between the traverses.

The slingram profiles for traverse *A*-100 are different from those of traverse *A*-200 for two reasons: 1) the response from wide conductors decreases as the coil spacing is decreased and 2) the depth of investigation is shallower. Disregarding the amplitudes of the anomalies, *A*-100 and *A*-200 are quite similar between 900 ft and 1400 ft south. This might be expected because the graphitic conductors in this region are probably too thin to cause the

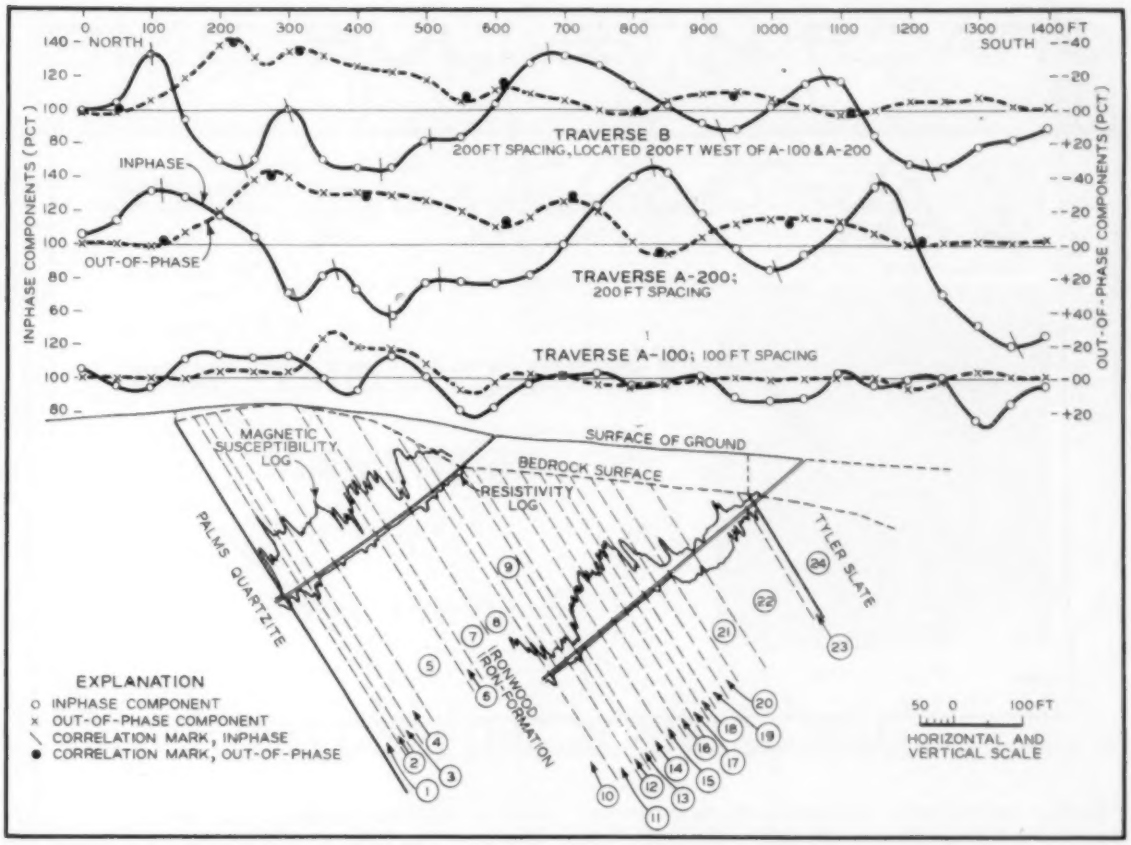

Fig. 3—Slingram profiles and electric logs from Gogebic Range. Rock types (numbered) are as follows: 1) granular jasper plus magnetite, hematite, silicate and carbonate beds; 2&3) thin-bedded silicates and magnetite; 4&5) granular jaspery chert with magnetite, hematite and silicate beds; 6&7) granular chert with wavy beds of magnetite; 8) thin-bedded carbonates, magnetite and silicates interbedded with thin-bedded granular jasper and chert, hematite and magnetite; 9) massive to thick-bedded silicates, granular chert; 10) granular chert and straight banded magnetite; 11) chert and silicates with disseminated magnetite; 12) chert and silicates; 13) graphitic slate; 14) thin-bedded magnetite and silicates, banded lenses of green chert; 15) chert, jasper conglomerate (some) and thin-bedded magnetite; 16) granular chert with disseminated, mottled and wavy-banded magnetite; 17) granular chert with disseminated, wavy-banded magnetite; 18) granular chert, even, wavy-banded magnetite; 19) granular chert with occasional thin beds of silicates and magnetite; 20) thin-bedded silicates, magnetite, and gray to pink granular chert bands; 21) dark gray slate, 22) banded, gray slate, silicates and magnetite; 23) thin-bedded silicates, chert and gray slate; 24) slate with gray nodules.

complicated effects of wide conductors and also because there is little effect of magnetic susceptibility. Between 100 and 900 ft south, traverse *A*-100 may be reconciled with traverse *A*-200, only if allowance is made for the effects of wide conductors and magnetic susceptibility.

Fig. 4 shows two slingram profiles and a dip-needle profile from another section of the Gogebic Range. The two components of the slingram profile are again near their normal positions over the footwall quartzite at *zero* south. Proceeding over the contact with the iron formation, the inphase component rises rapidly while the out-of-phase component remains near *zero*, again indicating a zone of high magnetic susceptibility and low conductivity.

Further south along the traverse, anomalies indicative of good conductors are found over a part of the iron formation and over the slates. As shown by the dip-needle profile, the magnetic field intensity increases sharply from the quartzite to the iron formation and then decreases slowly from the iron formation to the slates. There are a number of sharp lows over the iron formation.

Both the slingram and dip-needle profiles indicate clearly the quartzite and iron formation contact. Neither profile shows the exact location of the contact between the iron formation and the slates. However, as in the previous example (Fig. 3) there is good correlation between features on adjacent slingram profiles. These features represent physically, and probably stratigraphically, distinct units within the iron formation. If the stratigraphic units are known on one traverse by drill hole information, it should be possible to trace these units laterally for considerable distances by means of slingram profiles.

The highs and lows on the magnetic profiles, particularly some of the smaller features, do not always correlate well between adjacent traverses, probably because they are caused by changes in remanent magnetization. These changes in remanent magnetization have less relationship to actual stratigraphic units than do changes in electrical conductivity and magnetic susceptibility.

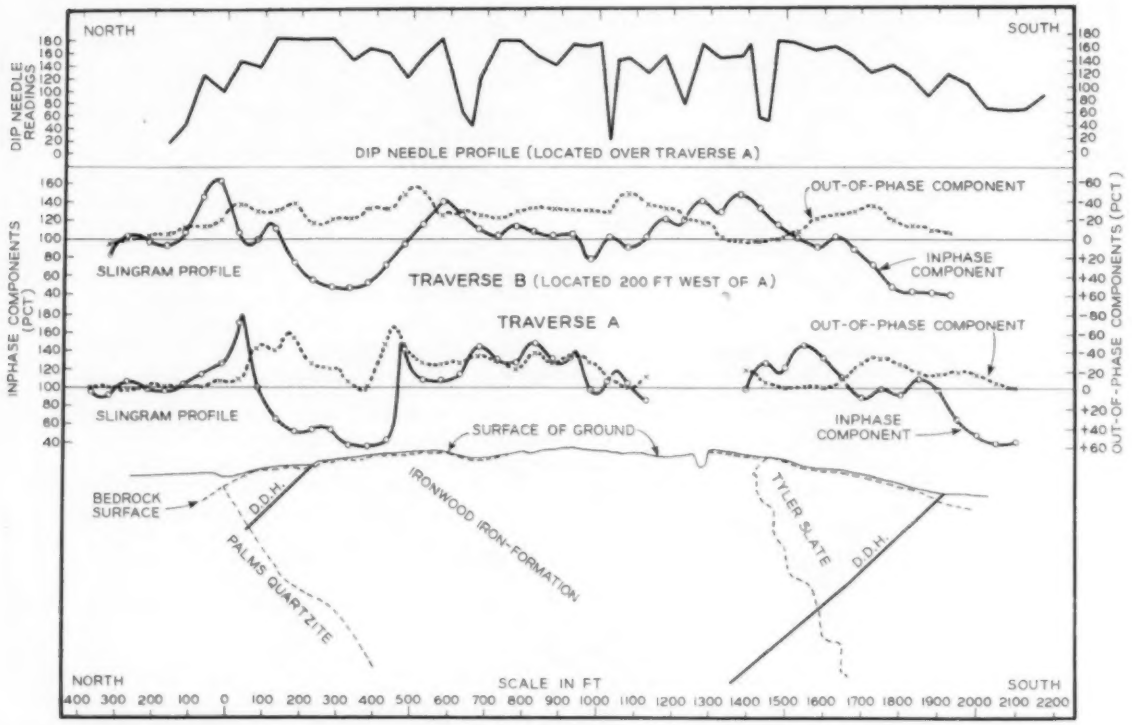

Fig. 4—Slingram and dip-needle profiles over iron formation on the Gogebic Range in the Lake Superior district.

Similar results were obtained over taconites on the eastern Mesabi Range, the chief differences being due to the lower dip of the beds in this area.

CONCLUSIONS

Oxidized iron ores beneath thick deposits of glacial drift on the Cuyuna Range could not be detected by electromagnetic surveys; however, graphitic or other conducting beds associated with the hanging-wall formation were readily located. Because conductive beds commonly occur in the hanging-wall formation of the Cuyuna and other ranges studied, electromagnetic methods should prove to be useful in mapping new areas in these ranges that contain oxidized iron ore.

Electromagnetic surveys were found to be a practical means of mapping magnetite-bearing, unoxidized iron formation on both the eastern Mesabi and western Gogebic Ranges. The magnetic taconite rocks were found to be conductive over broad areas and are easily traced, even under considerable thicknesses of glacial drift. The contact between the footwall and the iron formation is readily located, but the contact between the hanging wall and the iron formation is not delineated easily due to conductive graphitic strata in the basal part of the hanging-wall formation. Anomalies on electromagnetic profiles (slingram method) can be correlated from traverse to traverse, and if the stratigraphy is known on one traverse by drill-hole information or by surface exposures, it should be possible to trace the lithology laterally for considerable distances by means of electromagnetic measurements.

ACKNOWLEDGMENTS

The work on the iron ranges would have been impossible without the fullest cooperation of the mining companies involved. The authors wish to acknowledge the excellent cooperation and assistance received from the Oliver Mining Co. and the Hanna Mining Co. Messrs. Ralph Marsden, George Spencer, and John Owen devoted much time to the project and their helpful advice and assistance were invaluable.

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COMING NEXT MONTH

Available abstracts of Society of Mining Engineers 1962 Annual Meeting papers will appear in the November issue of MINING ENGINEERING. Additional abstracts will be published in the January 1962 issue and both sections will be compiled and published as the SME Abstract Book to be distributed at the meeting in February 1962.

Preprints will NOT be available until early 1962.

SME BULLETIN BOARD

Reports of Your Technical Society

OFF-THE-RECORD MEETING

NOVEMBER 3

(For details see page 1165)

Penn-Sheraton Hotel, Pittsburgh

POST-MEETING REPORTS FROM:

And Don't Forget the AIME Annual Meeting

February 18 - 22 in New York

(See page 1165)

WE'VE MOVED

See Page 1164 For the Story

OUR FAREWELL TO HERALD SQUARE

The second oldest professional society in America has a new home. Climaxing the years of planning and construction and through the largesse of your donations, the New York offices of AIME moved to the United Engineering Center over Labor Day weekend.

This new 20-story, $12,000,000 building opposite UN headquarters and the Carnegie Endowment for International Peace takes its place as a unit of the peace complex fronting New York's East River. With the move of personnel from 19 engineering organizations into the new headquarters, the Center has become the largest concentration of professional engineering societies in the Free World. Fourteen of the 19 organizations had been occupants of the old Engineering Societies Building on 39th Street which had been made possible by a gift from Andrew Carnegie 50 years ago. Funds for the new building have come in substantial part from the contributions of members of the Societies all over the world, from industry and from others interested in the project.

The Center is owned and operated by the United Engineering Trustees, Inc., an agency of the five Founder Societies: The American Institute of Mining, Metallurgical and Petroleum Engineers; the American Society of Civil Engineers; The American Society of Mechanical Engineers; the American Institute of Electrical Engineers; and the American Institute of Chemical Engineers. At present, Willis F. Thompson, former Vice President of The American Society of Mechanical Engineers, is President of UET. The Real Estate Committee, which was in charge of plans for the new building, is headed by Andrew Fletcher, a former President of both AIME and UET.

Formal dedication of the Center is scheduled for November 9 with Herbert Hoover as honorary chairman. His intense interest in the new Center has been demonstrated frequently—he officiated at both the ground-breaking ceremony and the laying of the cornerstone.

One of the outstanding attractions of the new Center is the Engineering Societies Library which is housed on the second floor. In its new home, the library has an eventual capacity of 255,000 volumes. Its present reservoir of 180,000 volumes, 27,000 maps and 10,000 indexed bibliographies probably qualifies it as the Free World's largest free public engineering library.

Other features of the glass, stainless steel and limestone structure are a marble-walled, terrazzo-floored entrance lobby with a display area on the east side; a main auditorium seating 434 people; meeting-dining rooms including one for 135 persons and two smaller ones for 20 each; and an employees' cafeteria.

The present occupants of the building, in addition to the five Founder Societies mentioned previously are: American Institute of Consulting Engineers; American Institute of Industrial Engineers; American Society of Heating, Refrigerating and Air-Conditioning Engineers; American Welding Society; Engineering Foundation; Engineering Index; Engineering Societies Library; Engineers' Council for Professional Development; Engineers Joint Council; Illuminating Engineering Society; Society of Women Engineers; The Municipal Engineers of the City of New York; United Engineering Trustees Inc.; and Welding Research Council.

For the present, two of the floors remain unoccupied. This allows flexibility for expansion either by present occupants or the inclusion of other organizations. Then too, with an eye to the future, the building is designed to permit additional construction so that the Societies won't outgrow their premises soon.

So after many years in the Herald Square "Millinery District" of New York, the Society of Mining Engineers has left behind the United Garment Workers of America and the United Hatters, Cap & Millinery Workers International. But our move was not to change neighbors or to have a new view. As proud as members of SME may be in becoming a part of the new United Engineering Center, the acquisition of new quarters is but one step toward the primary goal—more and better services for all members.

Whenever you are in New York, please make it a point to come up to the offices of your society. We are looking forward to seeing you all and discussing with you the ways and means of bettering the Society and the Profession.

UN Headquarters fronting the East River.

EAST SIDE WEST SIDE

New York in all its variety will again be the scene of the AIME Annual Meeting, February 18 to 22. The annual business meeting of the Institute will be held Tuesday, February 20, at 4:00 p.m., at meeting headquarters in the Statler-Hilton Hotel.

This year the Monday night Dinner-Smoker will be held at the Sheraton-Astor Hotel. Other AIME social events will be at the Statler-Hilton as follows: Welcoming Luncheon—February 19, Informal Dance—February 20 and the Annual Banquet and President's Reception —February 21. The SME Dinner February 20 will also be held there.

Times Square—showground of the world.

Off-the-Record Meeting Set

The Pittsburgh Section, now AIME's largest local section, is again preparing for its famous Off-the-Record Meeting to be held November 3 at the Penn-Sheraton Hotel. This will be the 16th annual meeting. As in the past, there will be five concurrent all-day sessions representing coal, petroleum, metals, mineral industries and open hearth interests. On the social side, a luncheon, cocktail party and dinner are scheduled.

Chairmen of the Program Committee are: R. T. Llewellyn—general chairman, R. C. Hall—general vice chairman, S. Krickovic—chairman, Coal Division, J. L. Schweizer —chairman, Petroleum Subsection, Robert Lenhart—chairman, Institute of Metals Group, R. G. Redelfs —chairman, Mineral Industry Group, J. T. McGlincy—chairman, National Open Hearth Committee. Earl B. Shaw is chairman of the Suppliers' Committee.

All of the morning sessions begin at 9:30 and the afternoon sessions begin at 2:00. The morning session of the Coal Division will concern itself with preparation plants. *Comparative Features of Preparation Plants in Northern West Viriginia* by H. L. Washburn, Mountaineer Coal Co. and *In The Pittsburgh Area* by D. G. Wener, Pittsburgh Coal Co. will be considered first. The second topic will be *Preparation Plant Revisions in Robena Plant, U. S. Steel Corp.* by J. C. Durfee and *In LaBelle Plant of Jones & Laughlin Steel Co.* by John Reilly. The afternoon session will discuss continuous miners. The first topic will be: *Continuous Mining in Thin Seams* with the *Joy Compton CU-42 Continuous Miner* by Norman Yarborough, Harlan Fuel Co.; with the *Lee-Norse LCM-28 Continuous Miner* by J. L. Marshall, Imperial Coal Corp.; and

(Continued on page 1166)

Inter-American Mining Seminar Held in Chicago

Sixty-four mining industry representatives from six countries attended the Inter-American Mining Seminar in Chicago's McCormick Place July 26, sponsored by International Minerals & Chemical Corp. in cooperation with the Chicago International Trade Fair. A question and answer period brought forth lively inquiries that shed further light on such subjects as Mexico's new mining code, Canada's marketing plans and U.S. views on inter-American cooperation in the development of natural resources. Principal speakers, pictured above, are from left to right: Jose Campillo, president, Mining Federation of Mexico; V. C. Wansbrough, managing director, Canadian Metal Mining Association; Nelson C. White, seminar chairman and vice president of International Minerals & Chemical Corp.; Marling J. Ankeny, director, USBM; and Daniel Kuri Brena, who was representing Mexico's Minister of National Patrimony.

Seated at the head table during the Idaho Mining Assn. luncheon are from left to right: O. E. Potier; Bruce Stoddard; Roger Pierce, AIME President-Elect; L. J. Randall, President Idaho Mining Assn.; R. R. McNaughton, AIME President; R. H. Crouse; C. J. Hicks; A. J. Teske, Secretary Idaho Mining Assn.; J. C. Kieffer, President-Elect Idaho Mining Assn.; and E. F. Cook, College of Mines, University of Idaho.

Mining Men Meet in Sun Valley

The Idaho Mining Assn. met July 5 to 7 at Sun Valley for a program that happliy balanced business and entertainment. Two technical sessions were held—one the morning of the 6th and one the morning of the 7th. Both sessions stressed governmental and legislative policies (both local and national) which have a bearing on the minerals industry. This scheduling of morning sessions only left the afternoons free to enjoy the many outdoor activities available at this famous resort site.

Highlighting the July 6th program was the AIME luncheon held in the Lodge dining room. Russell Crouse, vice chairman of the Snake River Subsection presided, with R. R. McNaughton, AIME President, the guest of honor.

The meeting ended the evening of the 7th with a suppliers' cocktail hour and a banquet which featured entertainment and dancing.

Off-the-Record

(Continued from page 1165)

with the *Jeffrey 100-L Continuous Miner* by a representative of Maust Coal Co. W. N. Poundstone, Christopher Coal Co., will present a paper entitled *Comparative Operating Features of Continuous Miners.*

The theme of the Mineral Industry Group sessions is **Radioisotopes—New Horizons in the Minerals Industries** and is being presented with the cooperation and assistance of the Office of Isotopes Development of the U.S. Atomic Energy Commission. The program follows: Under the general heading of **What Radioisotopes Can Mean to the Minerals Industry,** these topics will be presented: *Radioisotopes—Profitable New Tools for Industry* by Paul C. Aebersold, AEC; a film, *Industrial Applications of Radioisotopes;* and *Implications of Radioisotopes to the Minerals Industries* by Harold J. Rose, consultant. The morning session closes with two papers on the subject of radioisotopes in geology: *Radioactivity Dating of Major Earth Structures* by Samuel S. Goldich, USGS and *Borehole Applications of Radioisotopes* by A. H. Roebuck, The Western Co.

For further information and bulletins, circle the following numbers on the reader service card: 40, Jaw Crushers No. 062; 41, Rotary Fine Crusher No. 063; 42, Crushing Rolls No. 065; 43, Hammer Mills No. 084.

The afternoon session begins with a paper by Paul J. Blaetus, AEC on opportunities in industrial radioisotope technology entitled *Training for Industrial Applications of Radioisotopes.* The major portion of the afternoon session will be devoted to **Radioisotope Applications in Mineral Processing.** Six papers are scheduled: *Application of Nuclear Density Gauges in the Mineral Industry* by H. L. Cook, Jr., The Ohmart Co.; *Some Radiotracer Applications in Metallurgical Processing* by K. G. Broadhead and H. H. Heady, USBM; *Principles and Operations of Density/Moisture Gauges* by O. K. Neville, Nuclear-Chicago Corp.; *Radioisotopes for Coarse Ore Concentration* by H. Ramdohr and I. Donadieu, Massachusetts Institute of Technology; *Study of Radioisotope Applications in Copper Mining and Extraction—A Case History* by D. Bandel, Tracerlab Inc.; *Neutrons and their Applications in the Mineral Industries* by M. M. Turkanis, Nuclear Materials & Equipment Corp.

The Petroleum Subsection has scheduled three papers for both its morning and afternoon sessions. The Institute of Metals Group has four papers scheduled for the morning and five in the afternoon. The National Open Hearth Committee will hold an operating and a metallurgical session in the morning and a combustion and refractories session in the afternoon, followed by a panel discussion.

A special session for students will be held in the afternoon as part of the Student Affairs Program. Robert G. Redelfs, St. Joseph Lead Co., will discuss *What Industry Expects of a Young Engineer.*

Carolinas Section Plan Meeting

The Carolinas Section will hold its annual meeting November 4 at the Barringer Hotel, Charlotte, N. C. Under the direction of Program Chairman Neil O. Johnson and his committee, a technical session is scheduled for the morning at which papers on tungsten, copper and mica mining will be presented. In the afternoon a plant trip to Bowater Paper Plant at Catawba, S. C. is planned for members and their wives. The day-long meeting will end with cocktails and dinner at the Barringer Hotel where R. R. McNaughton, President of AIME, will be guest speaker.

ROCK IN THE BOX

Mining & Exploration Division

In July, MINING ENGINEERING announced that the Peele Award fund had been established. As you no doubt already know, $10,000 is needed to set up the award on an annual basis. This is an M & E award. Let us not have it said that the M & E Division is holding back. Send your dollar or more to:

Fund for Peele Committee
c/o Society of Mining Engineers of AIME
345 East 47th Street
New York 17, N. Y.

For those of you who think only of Peele as an expensive handbook or perhaps just another name in mining history, we are printing a biography based on one which appeared in MINING ENGINEERING at the time of his death.

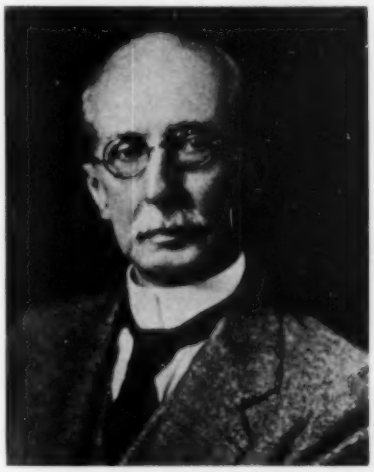
It is fitting to note that the Peele Award is for the younger men in the Society. This is the type of man that Peele was closely associated with during his long teaching career at Columbia.

The man whose memory is honored by the Robert Peele Memorial Award was one of the truly distinguished members of the mining engineering profession. He was born in New York City, July 15, 1858, and died there 85 years later. In the course of this long life span he was practicing engineer, educator and author. He gained world-wide fame with the publication in 1918 of *Mining Engineer's Handbook* which he edited.

In the fall of 1879 he entered the Columbia School of Mines and was graduated in the class of 1883. After graduation he began his field work as assayer of the Designolle Reduction Works near Charlotte, N. C., for $40 per month plus board.

The next year he was appointed foreman of the new dry-crushing, roasting and amalgamation mill of the Silver King Mining Co. located at what was then Pinal—now in the vicinity of Superior—Arizona. After two years of successful management he resigned; his reason for doing so illustrates his strict conscientious attitude. In those days, in the Far West, Sunday was like any other day as far as work was concerned. Peele never liked that idea and finally decided to give up an excellent chance for advancement in order to live up to his principles.

On leaving Arizona he went to England on a special mission, then back to Arizona for examination work. This was followed by a long trip into the interior of Colombia



ROBERT PEELE

to examine placer and gold and silver quartz deposits.

In 1889 Peele made a difficult prospecting expedition into the gold bush of Dutch Guiana where all traveling had to be done by launches, dugouts or on foot. Then for two years he was engaged in South America in examining gold, silver and tin mines for the Peruvian Exploration Syndicate Ltd. (London). While still in South America, he was offered the adjunct-professorship of mining in the School of Mines at Columbia, which he accepted. In 1896, as a secondary occupation, he became a member of the firm Olcott, Fearn and Peele (later Olcott, Corning and Peele), consulting mining engineers. In 1904 he was promoted to full professorship in mining and remained in that position until he retired in 1925.

Professor Peele was greatly beloved by the students and many were attracted to the School largely by his fine reputation. As a part of their training he insisted upon his students visiting or working in mines during the summer vacations. He sometimes led the mining field trips himself and expected the students to make detailed observations of everything connected with the mining operations.

Peele's interest in his students carried over to their jobs when they had finished school. One former student reports that after completing a job for a mining syndicate which operated an old abandoned silver mine in Peru, he visited Peele to tell him about it and, to his surprise, Peele went to his files and brought out a report which he had made on the mine more than 30 years before.

This same student recalls how Peele predicted that those in the mining profession would be confronted with a situation where the rich mines would be running out and would have to solve the problem of mining large low grade mines.

In 1903-04, while on leave of absence from the University, he traveled around the world visiting countries in Asia and Europe. In 1910 he visited Africa and South America.

In addition to his work on *Mining Engineers' Handbook*, Professor Peele translated from the German the work of J. Reimer, entitled *Shaft-Sinking Under Difficult Conditions* and wrote a series of articles on mining subjects for the *Encyclopedia Britannica*. His *Compressed Air Plant* appeared in 1908 and the fifth edition of this work in 1930. The second edition of *Mining Engineers' Handbook* was issued in 1921, and 20 years later the third edition appeared. By that time Peele's eyesight was failing and John Church helped him with the editing job.

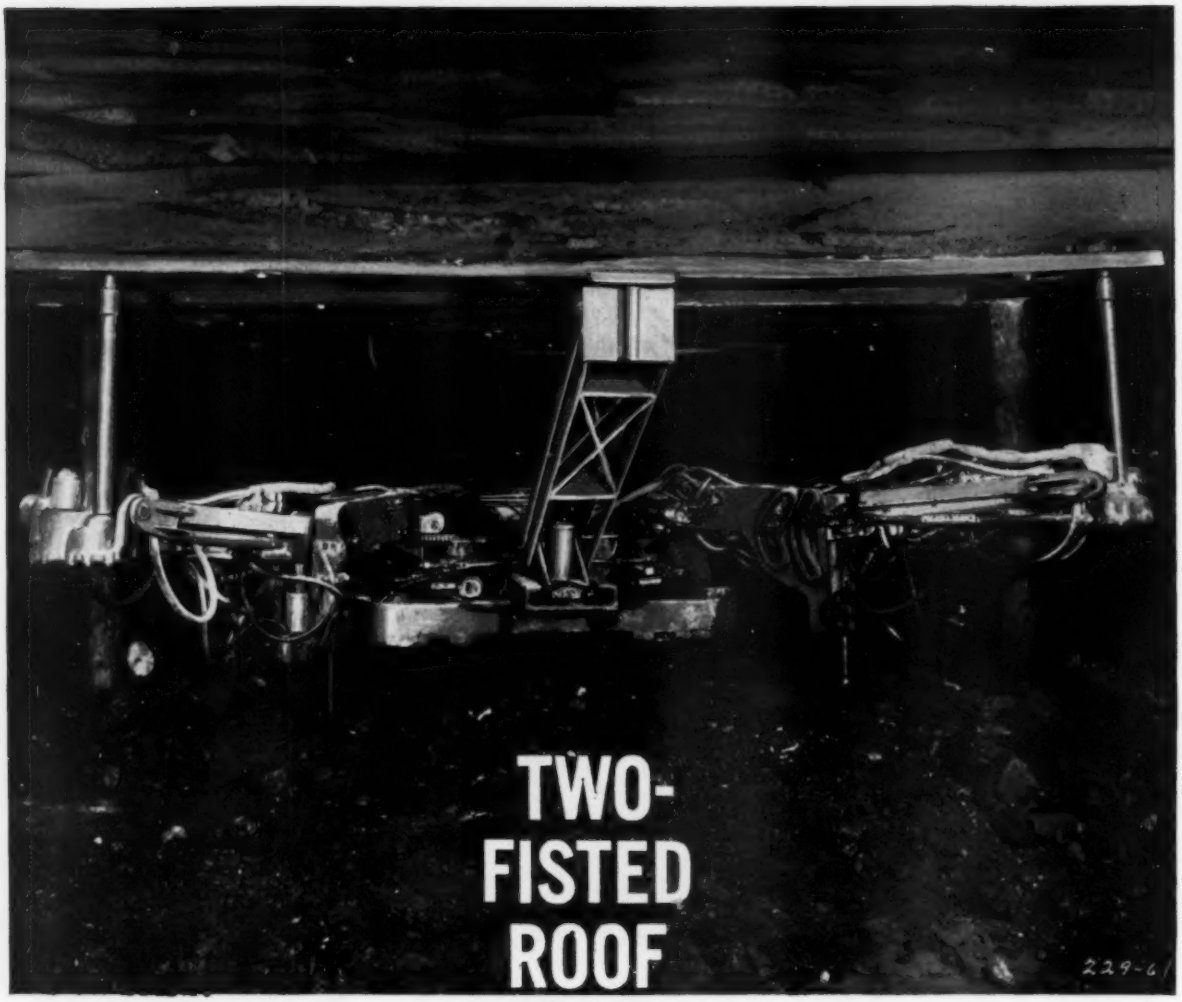
Professor Peele remained a bachelor all of his life and made his home with his two sisters. He was a constant visitor at the Century Club and so regular in his attendance that he was always expected at a certain time. He was an expert billiard player and always entered the club tournaments, but his handicap was so large that he never won the club championship.

He died, after a short illness, on Dec. 3, 1942.

M&E DIVISION NEWS EDITOR

Peter B. Nalle

Riverside Cement Co.
Box 832
Riverside, California



TWO-FISTED ROOF DRILL SPEEDS BOLTING OPERATIONS

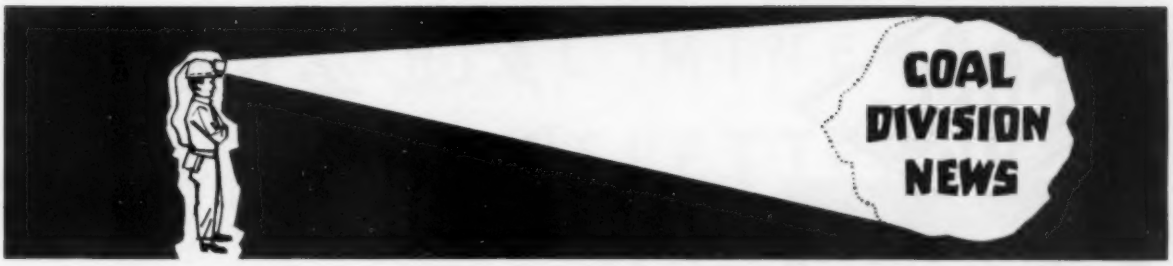
The double drilling arms on the power-packed Jeffrey 56-RDR2 Roof Drill increase production, slash overall bolting time. Each arm swings 80° from the forward position to cover a 24 ft. drilling range. The drill goes where you want it—when you want it. A hydraulically-operated timber-setter is also available for this machine. It provides a lift up to 7′ 2½″ above the floor. Makes timber-setting a breeze—cuts your costs on this time-consuming operation too! The 56-RDR2 includes hydraulic tramming on the two front wheels, hydraulic stick-steering for the two rear wheels and a hydraulically-driven automatic spooling cable reel.

The Jeffrey 56-RDR2 machine is available for 250 or 500 volts DC, or 440 volts, 3-phase, 60-cycle AC. A single-arm drilling machine can be supplied for the same voltages.

For full information write The Jeffrey Manufacturing Company, 865 North Fourth Street, Columbus 16, Ohio.

If it's conveyed, processed or mined, it's a job for Jeffrey

JEFFREY



Coal Research

The recent announcement by Interior Secretary Udall of the awarding of the first contract by the Office of Coal Research marks the beginning of a 10-year program of vital importance to the coal industry. The $139,000 contract with Booz-Allen & Hamilton of Chicago will finance a study designed to find new uses which will result in expansion of coal markets. The study will be directed primarily at stimulating demand for coal through the development of new products which are economically and technically marketable. Udall said that more than 100 contract proposals are in process of evaluation and additional contracts will be issued soon.

The Office of Coal Research was created by the 86th Congress specifically to coordinate research to develop new and more effective uses for coal, to expand present uses and to reduce production and distribution costs.

Behind Secretary Udall's announcement lies a story of delays and frustration. The present phase began in January 1960 when representatives of the coal industry and Interior Department spokesmen testified before a House Subcommittee on Mines and Mining that they favored enactment of a new compromise coal research bill to replace legislation that had been pocket-vetoed by President Eisenhower in the fall of 1959.

Passage of the proposed legislation would enable the Secretary of Interior to establish an Office of Coal Research within the Department to 1) plan a comprehensive coal research program; 2) coordinate private and governmental research projects; 3) develop in conjunction with advisory committees, specific projects to recommend directly to the Secretary; and 4) negotiate contracts by the Secretary with trade associations, educational institutions and appropriate State agencies.

It was felt that such a program would best meet the need for short-range coal research opposed to the long-range and medium-range research projects carried on by the Bureau of Mines. It is to the short-range research projects that the industry looks for developments of mining methods and equipment, as well as to ways of improving efficiency and thereby increasing the utilization of its product.

The Interior Committee report on the bill emphasized that the new research program would supplement —not replace—the USBM long-term research program, and went on to state:

"It is regrettable that the Bureau of Mines' concentration on long-range studies, useful though they are, its strong predilection for using only its own laboratories, and the history of unsuccessful past efforts caused such a lack of confidence in it that some witnesses who appeared before the committee expressed the view that they would prefer no bill to one that merely added the new functions and administrative machinery to the existing setup."

The bill was approved in the House on February 15, 1960 and, after the addition of minor amendments, it passed the Senate the end of June and was signed into law on July 7. The final appropriation bill to clear the 86th Congress provided the full $1 million requested to set up the Office with the stipulation that not more than $200,000 be expended for staff and administrative costs and the rest be used to inaugurate research.

After that, nothing was done until December 1 when the Interior Department named a 14-man committee (composed of members of coal management, labor and others) to act in an advisory capacity to the Office of Coal Research. By mid-January the chairman of the House Interior Committee issued a statement criticizing the Department of the Interior for its failure to get the coal research program under way promptly—pointing out that the position of Director of Coal Research had not been filled nor had the chief assistants been named.

It was not until April 1961 that George A. Lamb was appointed Director of the Office of Coal Research. The first meeting of the General Technical Advisory Committee was held on June 6 to brief the committee on the organization of the Office and to outline its future role as viewed by the Department of the Interior.

Secretary Udall's announcement of the letting of the first contract indicates that the project has finally gotten off the ground. The industry will watch with interest future developments of this program.

Coal Preparation Congress

The National Coal Board and the Coal Preparation Plant Assn. of Great Britain recently announced preliminary plans for the Fourth International Coal Preparation Congress to be held in Harrogate, England, May 28 to June 1, 1962.

Papers will cover all aspects of coal preparation, but particular emphasis will be placed upon: relationship between feed, composition, plant design and product quality; classification of sizes below 12 mm (½ in.); treatment of fine material; control of plant and products; and reduction in the free moisture content of material. Approximately 35 papers will be read during the Congress. Simultaneous interpreting will be provided in the three official languages of the meeting—English, French and German.

Visits will be arranged to collieries and coal preparation plants during the Congress. Delegates will have a chance to make two visits during the week of the Congress and, for those who wish, arrangements will also be made to see other plants in the week following the Congress.

A full program is being planned for the wives of those attending and two evening receptions are scheduled, one on Monday May 28 and one on Friday May 31.

The Congress will be open to all those engaged in the practice and research of coal preparation technology and to others working in coal mining and in industries associated with the mining and treatment of minerals. The registration fee will be $14.00 (£5) with additional charges for the Volume of Congress Proceedings and cost of transport on technical visits.

For additional information write directly to: The Secretary, Fourth International Coal Preparation Congress, National Coal Board, Hobart House, Grosvenor Place, London S.W. 1., England.

COAL DIVISION
NEWS EDITOR
RAYMOND E. DAWSON
Roberts & Schaefer Co.
201 North Wells Street
Chicago 6, Ill.

Around the Sections

• The **St. Louis Section** held its first meeting of the fall season September 8 at the Hotel York. Dale L. Fuller, senior geologist of the Missouri Geological Survey, gave an illustrated talk covering the Survey's groundwater level studies giving descriptions of methods, equipment and location of water wells. Illustrations, together with data and description of water level fluctuations caused by earthquakes, moon tides, trains, etc. were of particular interest.

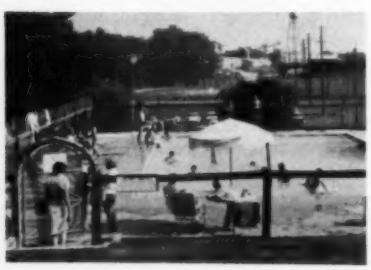
• The August 26 field trip of the **Adirondack Section** came under the heading of "top secret." By special authorization, made through arrangements with the Ballistics Missile Construction Office, members were able to tour Atlas "F" missile sites 4 and 10. Following the tour there was a dinner meeting at the Lewis Hotel in Lewis, N.Y.

• The **Bisbee-Douglas Subsection** (Arizona Section) met August 8 at the Warren District Country Club. Sixty persons were on hand to hear Kirk Carlton, Link-Belt Co., tell about the giant excavating wheels developed and used in Europe.

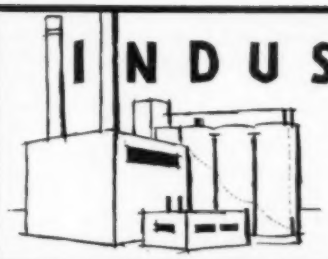
• Harry C. Webb, president of the Pan American Sulphur Co. of Houston, Tex., was speaker at the dinner meeting of the **Mexico Section** held August 14 at the University Club in Mexico City. The subject of Mr. Webb's talk was *World Economics of Sulfur Marketing.*

The Section's annual dinner-dance was held Monday night, September 4. Guests of honor were AIME President R. R. McNaughton and his wife.

• Over 200 people turned out for the picnic given by the **East Tennessee Section** the afternoon and evening of August 5. It was held at American Zinc Co. staff house area at Mascot, Tenn. The company put at their disposal the swimming pool, badminton court, shuffleboard court, horseshoe area and soft ball grounds. Floodlighting was provided after sundown for the diehards who were having too much fun to leave. Food, draft beer and soft drinks were furnished through the courtesy of about a dozen companies in the area.



Members of the East Tennessee Section, their wives, children and guests enjoyed an all-day outing the first Saturday in August at picnic grounds near Mascot. Pictured at the left: some members welcoming latecomers to the picnic area. Below left: A pleasantly relaxed group chatting, enjoying the refreshments and just plain taking it easy. Below right: the swimming pool was a popular attraction, with particular appeal to the youngsters.



INDUSTRIAL MINERALS NEWSLETTER

New York Meeting, February 1962

The Program Policy Committee has arranged an excellent series of papers for the Annual Meeting. Plan to attend. A complete list of papers, together with available abstracts, is scheduled to appear in the November issue of MINING ENGINEERING.

Industrial Minerals Gleanings from the Press

The liveliest indication of increasing prosperity in the nation is to be found in the Industrial Minerals Industry. Cited below are a few items that are typical in the news of the day.

July 20—August 20, 1961

A new diammonium phosphate production process, costing $3.8 million, is being installed at Bonnie, Fla., by International Minerals & Chemical Corp. The new product will use all the phosphoric acid capacity of the present Bonnie plant. The company expects the new product to displace some grades of triple super phosphate.

Tulsa Rock Co., a new firm, is building a $1.5 million crushed stone plant at Tulsa, Okla., with capacity of 300 tph that will employ 150 persons.

Dewey Portland Cement Co. dedicated its $13 million new plant northeast of Tulsa, Okla. Raw materials available from the 1500 acre site on which the plant is situated will supply it for about 250 years. The plant is of the latest design, with many automatic features. Five types of cement will be produced. Annual rated capacity of the plant is 1.25 million bbl.

Robinson Brick & Tile Co. plans to construct a new $1.75 million automated plant at Denver; capacity 60,000 bricks a day. Completion scheduled for February. (*Denver Post*, 6/18)

Cane Creek Potash complex of Texas Gulf Sulfur Co. has one of the largest head frames in the West. It is 185 ft tall and will serve a new 22-ft diam shaft. The property is in Grant County, Utah. (*Salt Lake Tribune*, 6/11)

The need for protection of zoning of sand and gravel deposits is again being demonstrated, this time in Denver. The *Denver Post* reports (5/29) that the Colorado Sand & Gravel Producers Assn. has completed a survey of the Denver metropolitan area that indicates that the area's known supply of "good, low-cost" gravel will be exhausted in 12½ years, at the present rate of consumption. Higher cost gravels will be exhausted in 38 years. One of the major problems of the industry is that "more than 50% of the land area which has gravel deposits has been built on and lost to our economy, perhaps forever."

The nepheline syenite plant of International Minerals & Chemical Corp. at Blue Mountain, Ont., is being expanded 25% to 135,000 tons yearly. The mineral is a prime ingredient of quality glassware.

Chrome ore from the Philippines now travels all the way by water to Pittsburgh. It is transshipped to barges from ocean vessels at New Orleans.

A new $100,000 brick kiln, being added to the facilities of Laird Brick Co. at Puryear, Tenn., will increase production by 50%, with a monthly capacity of 1.5 million bricks.

A $175,000 crushed stone plant, together with a $175,000 asphalt plant, is being installed at Goodlettsville, Tenn., by Dixie Pavers, Inc. The two plants will require 35 employes to operate them.

A new Dimension Stone (granite) quarry is being opened 15 miles south of Elberton, Ga., by Geo. T. Oglesby Granite Co.

Tennessee Copper has a new SO_2 unit that will increase the company's capacity to 90 tpd.

A $10 million expansion of the Estherhazy, Sask., potash plant has been announced by International Minerals & Chemical Corp., which will more than double its capacity to 1,000,000 tons annually.—*Leon W. Dupuy.*

Personals

Karel Roos, formerly an engineer with Atlas Consolidated Mining & Development Co. in the Philippines, has become assistant chief engineer for Mine Management Associates Ltd., Monrovia, Liberia. Before going to Liberia, he spent a leave in the Netherlands.

James Yancik is a mining engineer with Sahara Coal Co. He was formerly chief mining engineer for Enoco Collieries.

After two years study at the Harvard Business School, **Calvert Smith** has taken a position in the Data Processing Dept., Norton Co. in Worcester, Mass.

According to a recent announcement from The International Salt Co., **John L. Ryon, Jr.** has been appointed director of production. He was formerly assistant director of production under **Floyd G. Parrish,** who retired August 4th.

F. Gail Loper, International Minerals & Chemical Corp., has been transferred to Florida to become operations research analyst—Florida operations, after a year as mine foreman at the Noralyn mine.

R. F. Palmer has resigned from The Algoma Steel Corp. Ltd. where he was mine manager, to enter the teaching profession. He has accepted the appointment of associate professor of mining engineering in the department of geological sciences, University of Saskatchewan.

W. MITCHELL, JR.

Will Mitchell, Jr. was recently appointed director of the Research Div., Allis-Chalmers Mfg. Co. He has been acting director of the division since September 1960. Mr. Mitchell has been with the firm since 1947 when he became director of its basic industries laboratory. A short time later he was named research supervisor. In 1951 he was appointed assistant director and in 1956 associate director.

R. F. MATHER

Mine Safety Appliances Co. recently announced that it has consolidated the divisionalized research activities of the parent corporation and a research subsidiary. All basic research, product development and engineering will be centralized in a newly-established corporate Research and Engineering Div. Personnel and facilities of MSA Research Corp., a subsidiary engaged in highly diversified research projects, will also be integrated into the new division. **Roger F. Mather,** formerly associated with the Product Development Div. of U.S. Steel Corp., has been appointed director of the division.

After five years with Kaiser Steel Corp. where he worked as an ore dressing engineer, **Richard C. Forbes** has gone to Lima, Peru to work for Marcona Mining Co. He is superintendent of the crushing and gravity plants.

After five years with Pennsylvania Drilling Co. where he was general manager, **John H. Melvin** has opened an office in Pittsburgh as a consulting geologist.

James B. McKenzie, New Jersey Zinc Co., has been transferred from the engineering department at the

Flat Gap mine to the mine department at the Friedensville, Pa. mine.

Following completion of his work at the Missouri School of Mines for his M.S. degree in mining engineering; **Robert B. Hopler, Jr.** has become an engineer in the explosives development department of Hercules Powder Co. Before returning to school, Mr. Hopler had been a mining engineer at St. Joseph Lead Co. for three years.

Oscar A. Glaeser, vice president and general manager—Western Operations, U.S. Smelting, Refining & Mining Co., was recently elected chairman of the Utah Natural Resources Committee.

M. J. ANKENY

O. A. GLASER

Marling J. Ankeny, director, USBM, served as Secretary of the Interior Udall's representative at the Inter-American Mining Seminar held in Chicago, July 26 in conjunction with the Chicago International Trade Fair. He was one of a panel of speakers. (See page 1165 for more details.)

W. L. DOWDEY

R. PEMBERTON

Wayne L. Dowdey, vice president—sales for The Eimco Corp., has been transferred to the firm's head office in Salt Lake City from Birmingham, Ala. **Berne A. Schepman,** vice president of the Process Engineers Div., also has been moved to the Salt Lake City office from divisional headquarters at San Mateo, Calif.

Roger Pemberton will head the new Exploration Div. of Aero Service Corp. He will direct an expanded technical staff in providing new ground exploration and follow-up services, as well as airborne geophysical surveys. Prior to his new appointment, Pemberton was a technical representative for Canadian Aero Service Ltd.

American Cyanamid Co. recently announced the appointment of **B. M. Collinge** as New York district manager of the Explosives and Mining Chemicals Dept. He will make his headquarters at the company's main office in Bound Brook, N.J.

personals

continued

Allis-Chalmers Mfg. Co. recently announced the appointment of **James W. Snarr** manager of processing industry sales for the Chicago district to succeed **H. W. Schaub** who becomes manager, Midwest accounts, for the new cement industry department. Snarr had been a sales representative in the Chicago district for the past six years.

George M. Schwartz recently retired as professor of geology and director, Minnesota Geological Survey, University of Minnesota. He will continue to maintain an office in Minneapolis and will be available for consulting work. **Paul K. Sims** of the U.S. Geological Survey, Denver will succeed him as director of the Minnesota Geological Survey.

Frederic D. Hanson has started a consulting practice as mining geologist. For the past ten years he was geologist and engineer at the Abbott quicksilver mine in Lake County, Calif., where he was employed by the three successive owners of the mine.

Horace C. Van Meter, formerly division industrial engineer for Jewell Ridge Coal Corp., has become assistant mining engineer at Wisconsin steel coal mines of the International Harvester Co.

After a period as mine trainee with American Metal Climax Inc., **Reed M. Miller** has accepted the position of assistant mining engineer with The Anaconda Co.

D. M. SOBRAL

L. R. STOISER

After seven and a half years in Chile as sales manager for Cia Sud Americana de Explosivos (a subsidiary of E. I. du Pont de Nemours) covering Chile and Bolivia, **Daniel M. Sobral** has returned to the U.S. to become sales representative for E. I. du Pont de Nemours & Co. Mr. Sobral is making his headquarters in Durango, Colo., from which he will cover the Four Corners area generally.

Lee R. Stoiser has become general superintendent of Todd Industries' Asbestos Fiber Div. He was previously employed by Paul Weir Co., and for the past two and a half years was a mining consultant to the geological and mining departments of the Korean Government and to the mining department of the International Cooperation Administration in Korea.

Albert Reilingh has become general manager of C. H. McInnis Co. Ltd. which supplies automated material handling systems and does custom designing on conveying systems. He was formerly with Consolidated Denison Mines.

After a year working in the New Mexico uranium mining district where he was general mine foreman for Hidden Splendor Mining Co., **Edward Von Moss** has returned to Fenix & Scisson Construction Co. as shift foreman. He had been associated with the company prior to going to New Mexico.

The Atomic Energy Commission recently announced the appointment of **John X. Combo** as chief counsel of the Grand Junction Operations Office. He succeeded **Paul B. Martin** who left government service after 33 years.

After completion of a two and a half year assignment as technical advisor to the Mexican government on geologic matters under the auspices of the International Cooperation Administration, **Ralph L. Miller** has returned to domestic research

with the U.S. Geological Survey in the southern Appalachians.

S. Parker Gay, Jr. has established a mining geophysicist consulting service in Lima, Peru. Prior to venturing on a business of his own, he was a geophysicist with Marcona Mining Co. at the San Juan, Peru, operation where he was engaged in exploration for new iron ore deposits.

John Barclay, formerly a field geologist with Ashanti Goldfields Corp. Ltd. in Ghana, has gone to Australia to become resident geologist with the Bureau of Mineral Resources at Tennant Creek, Northern Territory.

Dan W. Martin has become managing director of Mykobar Mining Co., Athens, Greece, in which capacity he is in charge of sales, shipping and helps coordinate mining and production of barite and bentonite. He was formerly production manager for Magcobar Iran with headquarters in Tehran.

G. D. GRAYER

S. A. STONE

Seldon A. Stone, formerly assistant drill sales manager for Bucyrus-Erie Co., has been promoted to drill sales manager, succeeding **George D. Grayer** who has been appointed sales manager of the company's newly formed midwestern region, with headquarters in St. Louis.

W. J. PARKS

E. E. GARDNER

The W. S. Tyler Co. recently announced the following two personnel appointments in its expansion program: **Walter J. Parks,** formerly chief engineer of the Screening Machinery Div., has been named director of product development for the division, and **Edgar E. Gardner** has been promoted from assistant chief engineer to chief engineer.

Melvin C. S. Chang, formerly research supervisor of the chemical engineering and mineral processing section of Crucible Steel Co. of America, has become research supervisor of the raw materials group of Youngstown Sheet & Tube Co.

C. S. Venable Barclay, formerly geologist with Bear Creek Mining

personals

continued

Co., has become a geologist with the Mineral Classification Branch, Conservation Division of USGS. Mr. Barclay was engaged on a field mapping project in Montana during the summer.

Ted D. Haley, a salesman with Spencer Chemical Co., has been transferred from the Birmingham, Ala., territory to the Kansas City, Mo., office to work in the Technical Service Group of The Blasting Agents Section as a technical sales representative.

Robert J. C. Tait, formerly metallurgical superintendent for Giant Yellowknife Mines Ltd., has become manager of Lakefield Research of Canada Ltd.

Helmut Leidhold has become general superintendent for Empresa Minera Pan de Azucar.

Don E. Williams, formerly a field geological engineer with the Baroid Div., National Lead Co. doing geologic mapping and exploration in the Ouchita Mountains of Arkansas, has become a mining engineer with USGS' mining operations branch in Billings, Mont.

After more than 20 years with American Cyanamid Co., **R. H. Lowe** has gone with Tri-State Zinc Inc. to assume the position of assistant manager of its new market development department.

Frank A. Colbert, formerly an office engineer for Kennecott Copper Corp. at Santa Rita, N. M., has moved to Arizona to take a job with Bagdad Copper Corp.

J. H. BRIGHT

W. E. GOODMAN

J. H. Bright has been appointed district superintendent for the western U.S. by Asbestos Corp. (Explorations) Ltd. Mr. Bright has been engaged in mineral exploration in the U.S. for the past ten years. He will make his headquarters in Santa Rosa, Calif.

William E. Goodman has retired as chairman of the board of directors, Goodman Mfg. Co., and is being succeeded by **Howard Goodman,** president and chief executive officer, posts he will continue to fill. **John S. Newton** has been appointed executive vice president. He will devote attention to the coordination of the company's engineering and manufacturing activities as well as continuing to be responsible for the firm's mine machinery engineering and development.

J. S. NEWTON

H. GOODMAN

John Y. Cole, Jr., formerly mine superintendent for Minera San Martin, S.A., has become mine foreman for Cia. Minera Asarco, S.A.

Following graduation from the University of Buffalo, **John P. Doerr, Jr.** became a research chemist at the Johns-Manville Research Center in Manville, N. J.

The Anaconda Co. recently announced the retirement of **Robert L. Thompson,** superintendent of its East Helena slag treating plant. Mr. Thompson came to the East Helena

plant while it was being constructed in 1927 and has been there ever since.

Robert W. DeMott, Chain Belt Co., has been transferred to Philadelphia to take over the position of eastern regional manager left vacant by the transfer of **Harold M. Weil** to Milwaukee. Mr. DeMott was formerly district sales manager of the Los Angeles office.

Following graduation from the University of Arizona, **Bruce E. Grant** became a junior engineer in the Chino Mines Div. of Kennecott Copper Corp. in Silver City, N. M.

J. W. SULLIVAN

E. E. COCKRELL

Several appointments have been made in the Screening Machinery Div. of The W. S. Tyler Co., according to a recent announcement. **James W. Sullivan** was named chief application engineer; **Edwin E. Cockrell** was named director of customer service laboratory; and **Sherman Telling** was named manager of the machinery service department.

Esco Corp. recently announced the appointment of **Henry T. Swigert** to the position of vice president—finance. For the past two years he has been an Esco sales representative in Phoenix, Ariz.

S. TELLING

H. T. SWIGERT

Madan M. Singh joined Gulf Research & Development Co. as a research engineer following completion of his work for a Ph.D. in mining engineering. He will be doing research in rock mechanics and drilling.

Following a year as graduate trainee with Allis-Chalmers Mfg. Co., **David M. Kjos** has become an application engineer in the grinding machinery section of the Processing Machinery Dept. in Milwaukee.

J. F. Brenton, formerly administrations manager for Union Carbide Nuclear Co., has been transferred to California where he has assumed the responsibilities of personnel manager. The move made it necessary for him to resign as president of the Colorado Mining Assn.

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There's a special place reserved in Excavator Engineering Heaven for the men who designed this remarkable Marion propel brake. Note the location? Right out in the open where it's easy to service. Notice, too, the single hydraulic spring adjustment that rarely needs attention. To protect against rock slides, the entire assembly is enclosed in an easily removable metal cover. You can't see it here but a simple gear ratio multiplies the initial braking force into many thousands of pounds of holding force at the crawlers—where it counts. But, perhaps the most remarkable point of all is the basic simplicity of a *single* braking point. Routine maintenance becomes just that... a sort of ho-hum operation since all components are fabricated from special steels designed for extra-fast heat dissipation. And response? Let's put it this way. When the operator flips the convenient electric control switch up in the cab, this Marion will stop RIGHT NOW. Marion Quality in action? We think so. Marion Power Shovel Company, Marion, Ohio. A Division of Universal Marion Corporation.

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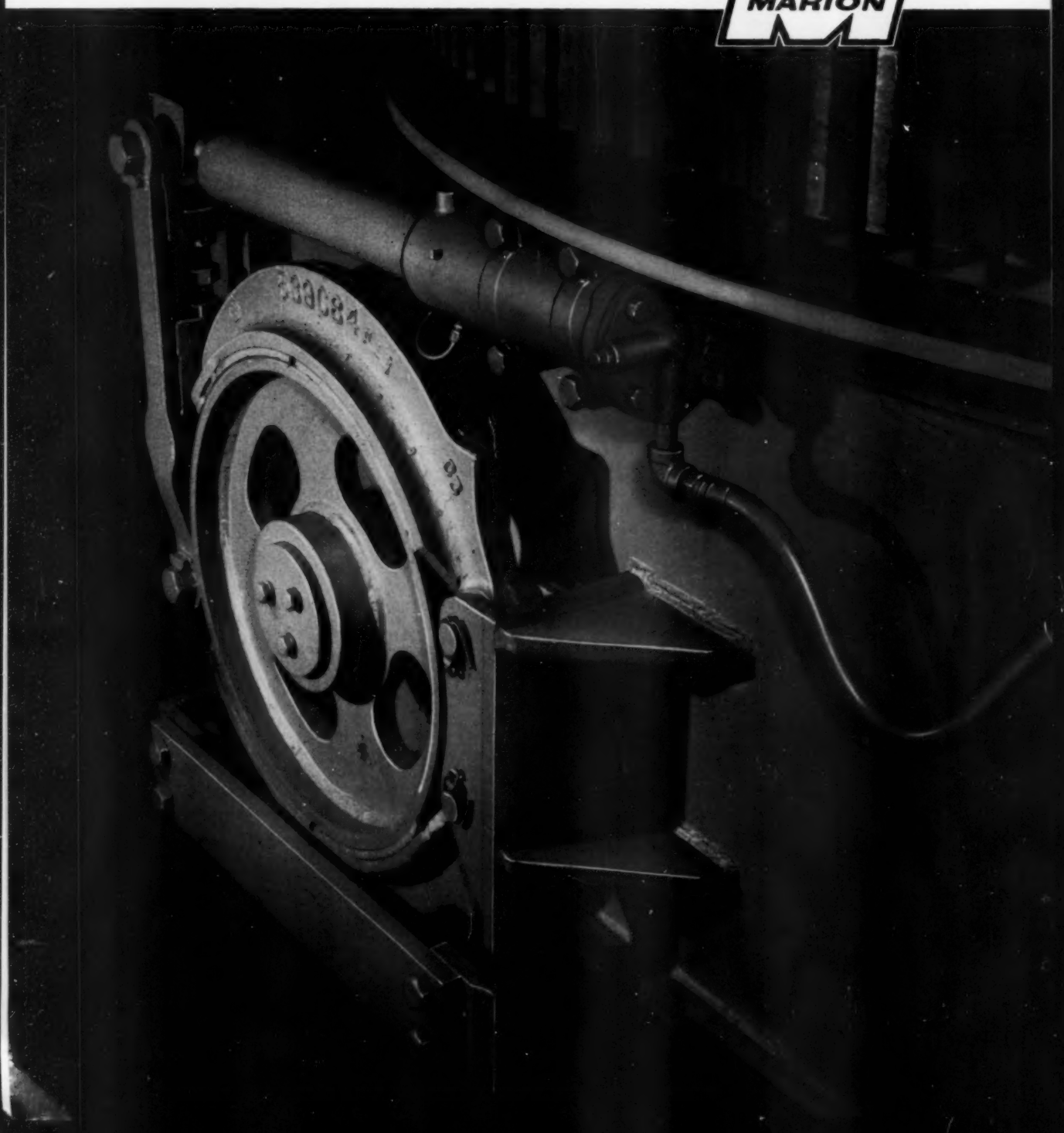

personals

continued

plant while it was being constructed in 1927 and has been there ever since.

J. O. Eby has been appointed vice president of Canadian Johns-Manville Co. Ltd. In addition to his new responsibilities, he will continue to serve as manager of Jeffrey mine a position he has occupied since 1951.

Karl V. Lindell has been named president of the administrative council of Canadian Johns-Manville Co. Ltd. In addition, he will continue to serve as general manager of the Asbestos Fibre Div., a position he has held since 1951. Mr. Lindell will continue to maintain his headquarters in Asbestos, Que.

Keith E. Wick has assumed full responsibility for the recently organized Denver SRL Pump Div. Prior to his promotion, Wick was a field engineer.

William Berry, head of petrographic research for Bituminous Coal Research Inc., has been appointed a member of the International Committee on Petrographic Standards. Mr. Berry recently joined BCR after serving as consultant on petrographic research to a number of industrial firms.

The U.S. Senate has confirmed the reappointment of **Edward Steidle** to the Federal Coal Mine Safety Board of Review for a new term expiring July 15, 1964.

Bear Creek Mining Co. has transferred **Robert E. Holt**, geologist, from its Spokane office to the Tucson, Ariz., office.

A. E. Walker, consulting geologist for The M. A. Hanna Co., has moved his headquarters from Cleveland to Three Lakes, Wis.

James C. Dorian, formerly a buyer for U.S. Gypsum Co., has become assistant to the president of Private Enterprise Inc., a company engaged in building low cost homes throughout Latin America.

William R. Bradley & Associates, environmental health consultants, recently announced that **Arvil B. Pettit,** formerly director of industrial Health and safety for W. R. Grace & Co., has joined their firm as a consultant on safety, fire and explosion and marine hazards.

The Refractories Div. of E. J. Lavino & Co. recently announced the following appointments: **George A. Brunner** as assistant district sales manager—Pittsburgh district; **Harry J. Hausner** as assistant district sales

personals

continued

manager—Chicago district; and **John N. Herbst** as assistant district sales manager—Philadelphia district.

George H. Love, chairman of the board of Consolidation Coal Co., was recently elected chairman of the executive committee of Chrsyler Corp. In order to take an active part in the company's affairs, Mr. Love has resigned as chairman of M. A. Hanna Co. and as director and member of the executive committee of National Steel Corp. He has not relinquished his position with Consol.

Stephen F. Turner, formerly a mining engineer at Kaiser Steel's Eagle Mountain mine, has been transferred to the company's Sunnyside coal mines and made section foreman of the No. 3 mine.

H. A. MONSOR

W. J. LaMORTE

Harold A. Monsor, who for the past two years was production manager at Dorr-Oliver's Hazleton, Pa., plant, has become director of production at Stamford, Conn. In his new post at the company's international headquarters he will have administrative responsibility for production and purchasing operations at Stamford and for the company's manufacturing operations at Englewood, Colo.

In a move to streamline and consolidate its research, administrative and educational procedures, the University of Alaska has established six academic colleges and named **Earl H. Beistline,** formerly dean of the School of Mines, to the post of dean of the College of Earth Sciences and Mineral Industry.

Willard J. La Morte, president of Richmond Screw Anchor Co., has been elected president of Shattuck Denn Mining Corp., succeeding **Thomas Bardon** who will continue as chairman. Mr. La Morte has been executive vice president of Shattuck Denn Mining Corp. since 1959. He has been president of Richmond Screw Anchor Co., a subsidiary of Shattuck Denn, since 1958.

E. C. Griggs has become U.S. sales manager for Nortons-Tividale Ltd.

of England. The company manufactures heavy medium equipment for both coal and heavy ore and has plants in South Africa, as well as in England. This is its first venture in the U.S. Mr. Griggs is headquartered in Chicago. He was district manager for McNally Pittsburg Mfg. Corp. for 17 years. Just prior to this new venture he was associated with Roberts & Schaefer for a brief period.

Obituaries

Harold E. Heide (Member 1942) died June 20, 1961, in Manila, Philippines, where he was consulting engineer of Surigao Consolidated Mining Co. Inc. He was born in Winslow, Ariz., Aug. 20, 1898, and was a graduate of the University of California. Following graduation he engaged in geological reconnaissance, mine surveying and mapping in Canada and Mexico for a number of firms. In the early '30's he worked successively as engineer, mine foreman, geologist and superintendent for Black Wonder Mine, F. W. Wakefield (both of California) and S. Gillespie, Tarrytown, N. Y. In 1936 he went to the Philippines where he worked as general superintendent for Mineral Resources Inc. His Association with Surigao Consolidated Mining Co. began in 1945.

Russell P. Henry (Member 1958) died Oct. 7, 1960, at the age of 50. He was born in Pierre, S. D. At the time he joined the Institute he was a sales representative for E. I. du Pont de Nemours & Co. working out of Madison, Wis. At the time of his death he was a resident of Platteville, Wis.

C. E. S. Rau (Member 1920) died recently in Bangalore, India. He was over 80 years old. Born in Madras, he attended schools in Mysore and Bangalore as well as Madras University. While working for the government of Mysore he studied mining in the gold fields under a government scholarship. Upon completion of his studies he was confirmed as a mining assistant in the government's geological department. By 1915 he was subinspector of mines.

Andrew Rostosky, Jr. (Member 1940) died in an accident Aug. 3, 1960. He was 46 years old. A native Pennsylvanian, he was a graduate of Pennsylvania State College. Prior to attending college, he worked for five and one-half years as coal sampler, shipper and miner for Pittsburgh Coal Co. and returned to work for them after receiving his B.S. and M.S. degrees. In 1947, after service with the U.S. Navy, he returned to Penn State as a research assistant. In 1948 he became eastern representative for *Mechanization, Inc.* and later district manager. By 1959 he was with U.S. Rubber Co., in Johnstown, Pa., where he remained until his death.

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The Institute desires to extend its privileges to every person to whom it can be of service, but does not desire as members persons who are unqualified. Institute members are urged to review this list as soon as possible and immediately to inform the Secretary's office if names of people are found who are known to be unqualified for AIME membership.

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Date Elected	Name	Date of Death
1933	Hubert O. De Beck	July 31, 1961
1948	J. J. de la Fuente	Nov. 20, 1960
1944	Duncan D. Forbes	June 19, 1961
1956	Joseph Gold	June 10, 1961
1939	Arthur Linz	Mar. 29, 1961
1921	H. E. McKinstry	June 30, 1961
1928	C. M. Nebeker	Unknown
1912	Arthur Notman	July 19, 1961
1932	Daniel L. Ogden	Aug. 4, 1961
1951	Robert Randall	Oct. 19, 1960
1954	Alden Safford	June 13, 1961
1921	Mat Sample	Unknown
1919	Grant Snyder	Aug. 17, 1959
1936	Kelvin Sproule	Aug. 8, 1961
1946	Tom Stark	Aug. 3, 1961
1960	Arne O. Tuomala	June 2, 1961
1918	W. A. Weldin	July 29, 1961
1943	James R. Welsh	Aug. 12, 1961

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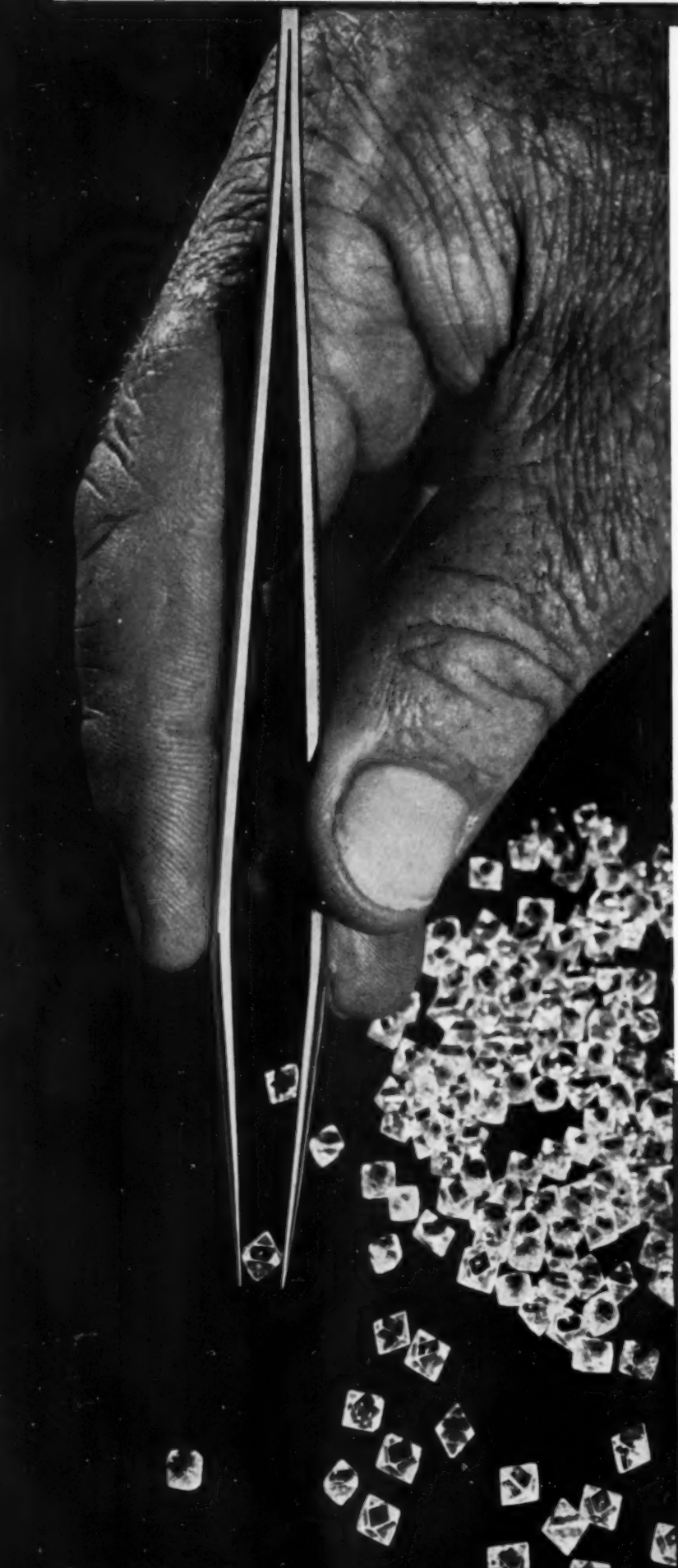

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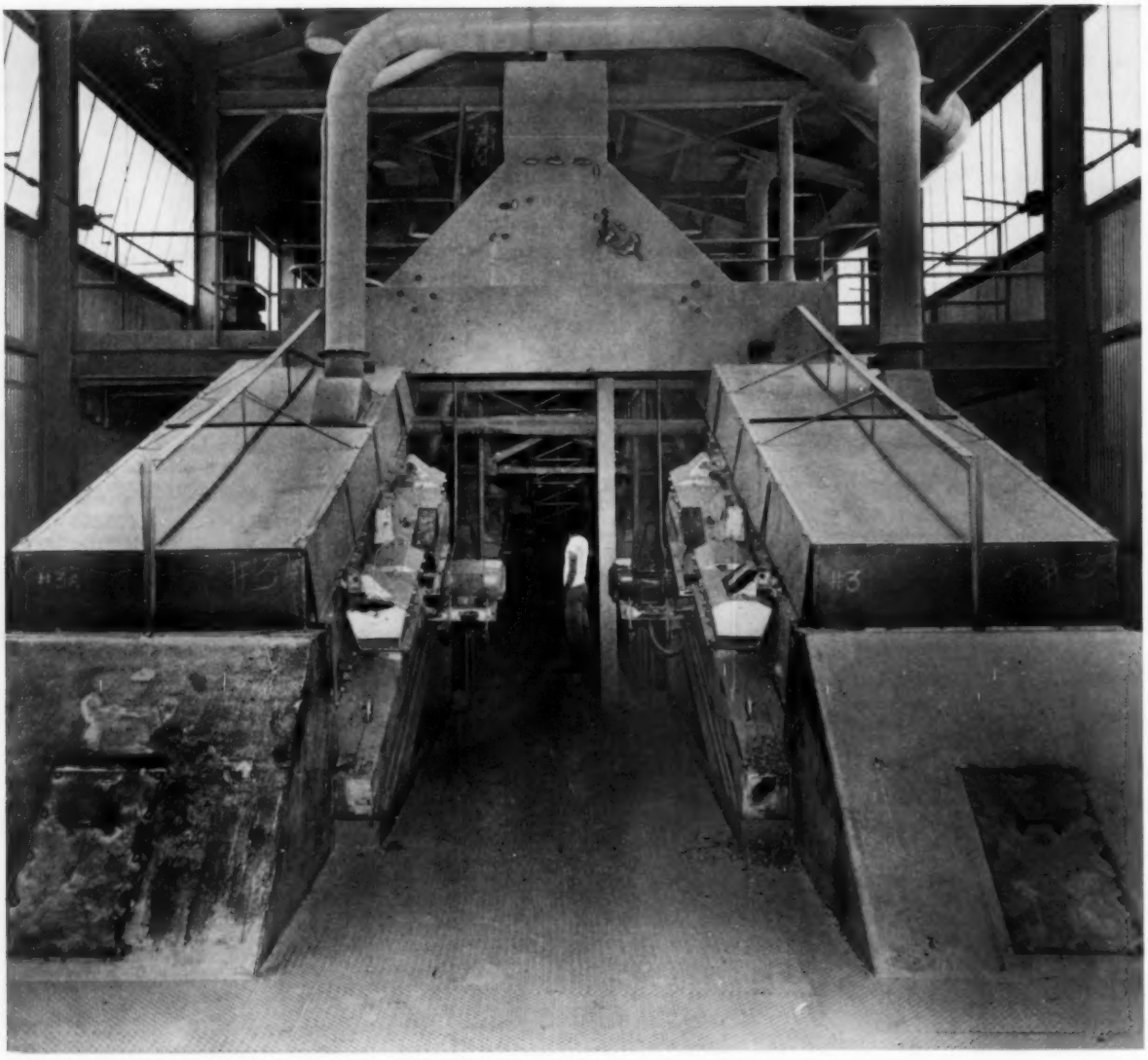

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